National Library of Canada
Bibliothèque nationale du Canada

Canadian Theses Service
Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, tests publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30.

NL-339 (r. 88/04)

Canada

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

STUDENTS' PERCEPTIONS OF COMPUTER USE IN ART EDUCATION

by

WADE VERNON PIKE

A DISSERTATION SUBMITTED TO

THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPARTMENT OF SECONDARY EDUCATION

EDMONTON, ALBERTA

FALL, 1988

Permission has been granted to the National Library of Canada to microfilm this thesis and to lend or sell copies of the film.

The author (copyright owner) has reserved other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without his/her written permission.

L'autorisation a été accordée à la Bibliothèque nationale du Canada de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur (titulaire du droit d'auteur) se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation écrite.

ISBN 0-315-45445-8

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: Wade Vernon Pike

TITLE OF THESIS: Students' Perceptions of Computer Use in Art Education

DEGREE: Doctor of Philosophy

YEAR THIS DEGREE GRANTED: 1988

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

Wade Pike

(Student's Signature)

50 Wellington Crescent, Mt. Pearl

(Student's Permanent Address)

Newfoundland, Can. A1N 2E2

Date: Oct 13, 1988

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled:

Students' Perceptions of Computer Use in Art Education

submitted by Wade Vernon Pike

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Art Education

J. Jagodzinski
Supervisor

External Examiner

K. E. Jaehnicke

Robert J. Burch

Jill Parsons

D. Wanyler

Date: Oct 12, 1988

Dedication and Acknowledgements:

I would like to thank my wife, Avril, who has kept me going and supported me throughout these four years, and for accepting with me all those things that our family had to wait a little longer for.

I would also like to thank my two boys Aaron and Kyle for all of the many times in which they understood that their Dad had "work to do" and "would be finished soon." Their extreme patience is always appreciated.

Dr. Jan Jagodzinski has been consistently supportive and encouraging to me, and I would like to thank him for all he has done to help me complete this dissertation and the related studies. He has always taken an open and supportive approach to differing ideas, allowing them the opportunity of proving their worth.

Finally, I would like to thank the office staff who have kept me from losing my place when forms needed filling and registrations were due. Thanks Chris and Barb.

ABSTRACT

This study has inquired into the art experiences of elementary and secondary students in respect to the manner in which computers might be accepted by them in the making of their art. Two groups of students were observed and interviewed as they made an effort to utilize the Macintosh computer's special features in their art making over a one month and two week period respectively.

Data was gathered by means of observation, a questionnaire, interviews, discussions, essays and the art work itself which was produced by these students. All data was then compiled and analyzed to establish what basis might presently exist for the existence of computer-assisted graphics use in the art educational environment.

Differing ages of the students resulted in different expectations and levels of satisfaction. The elementary students were primarily interested in discovering what capabilities the computer possessed. They would engage in long sessions of exploration to become as familiar as they could with single aspects of the program's features. Usually the subject matter of what they drew was considered of little importance to them as long as it provided a vehicle for extended use of a specific *tool* . The experience of drawing on the computer was considered to be of at least equal value to the execution of any predetermined image.

While younger students tended to make this experience meaningful by becoming involved in the making process and letting themselves be guided by a sense of adventure and exploration, the older students tried to control the experience, to make the computer behave as much as possible like the traditional art materials. This led to frustration on the part of many of the secondary students and seemed to be in conflict with their expressive wants. In fact the tendency to attempt to achieve technical dominance was the single most noticeable trend in the senior experience.

There are several implications for Art Educators in this study that are drawn from its conclusions. These are in regard to teacher training, issues of pedagogy specific to Art Education, student comprehension and responsiveness, and computer familiarization.

"An ounce of experience is better than a ton of theory."

John Dewey, from *Democracy and Education*, 1916

"The real study of an art student is generally missed in the pursuit of a copying technique."

Robert Henri, from an address made to the students of the School of Design for Women, Philadelphia, 1901

"An ounce of experience is better than a ton of theory."

John Dewey, from *Democracy and Education*, 1916

"The real study of an art student is generally missed in the pursuit of a copying technique."

Robert Henri, from an address made to the students of the School of Design for Women, Philadelphia, 1901

TABLE OF CONTENTS

One: Art Education & Computers

Introduction 1
Computers in Education 2
Computers and Art Education 5
Statement of the Problem 12
The Means of Inquiry 14
Limitations of the Study 18
Definitions 18

Two: Background to the Study

Technology and Art Education 20
Technique in Art Education 22
Art with Machines 24
Questions of a Social Nature 31
Questions of Pedagogy in Art Education 35

Three: Elementary Art Students

Elementary School Students 38
Introduction 38
The Students 39

Four: Secondary Art Students

Secondary Art Students 72
Introduction 72
The Students 73

Five: Summary of Student Experiences

Introduction 125
Elementary Students 125
Secondary Students 128

Six: Findings of the Study

Introduction 136
Contents of Pictures 137
Content or Concept as Priority 138
Experimentation as Priority 139
Enjoyment 140
Rationale 140
Simulation 141
Tools/Techniques 142

Seven: Conclusions, Implications, Recommendations

Conclusions 145
1. The Place of the Computer in an Art Setting 147
2. Student Differences 148
3. Technical Priorities 148
4. Social-personal Issues 150

5. Student Perceptions 150
6. Simulation 151
7. Pedagogical Efficacy 153
Implications: New Issues in Art Education 154
1. Teacher Education 155
2. Pedagogical Issues in Art Education 156
3. Student Comprehension and Responsiveness 158
4. Computer Familiarization 158
Recommendations 159
1. Teacher Education 159
2. Curricular Responsiveness 159
3. Materials Evaluation 160
4. Additional Research 160
Postscript 161

Bibliography

Bibliography 163

Appendices

APPENDIX A: Inside MacPaint 170
APPENDIX B: Elementary Students 177
APPENDIX C: Secondary Art Students: The Questionnaire 186
Essays 193
APPENDIX D: Discussion: Secondary Art Students 203

LIST OF ILLUSTRATIONS

ELEMENTARY STUDENTS

FIGURE	NAME	STUDENT	PAGE
E1	"Auger and Truck"	Greg	48
E2	"The Big House"	Greg	48
E3	Castle	Greg	49
E4	"The Planet of Silver"	Greg	49
E5	Tree	Greg	50
E6	"See the Funny Spider"	Greg	50
E7	"This Maze is Flooded"	Greg	51
E8	"Red Rose"	Greg	51
E9	Farm Tractor 1	Jon	52
E10	Farm Tractor 2	Jon	52
E11	Waffles 1	Jon	53
E12	Waffles 2	Jon	53
E13	Animal Figure	Paul	54
E14	"Space"	Greg and Jon	54
E15	"Designworld"	Matthew	55
E16	Tulip	Matthew	56
E17	Garfield	Matthew	56
E18	"A Flower"	Matthew	57
E19	Flowers	Matthew	57
E20	"Scale"	Matthew	58
E21	"Grandmother's House"	Matthew	58
E22	Horse and Cart 1 & 2	Matthew	59
E23	"The Dinosaur Statue"	Matthew	59
E24	"Jack and the Beanstalk"	Matthew	60
E25	"John Walter Site"	Matthew and Jared	61
E26	Dental Package	Jared	61
E27	"Sunny Day"	Trina and Jody	62
E28	Breakfast Table	Trina and Jody	62
E29	"Clown"	Trina and Jody	63
E30	Easter Egg	Trina and Jody	63
E31	"King Tut"	Trina and Jody	64
E32	Lady's Face	Trina	64
E33	"Grandma"	Jody	65
E34	"Grandpa"	Jody	65
E35		Aaron	66
E36		Aaron	66
E37		Aaron	67
E38		Aaron	67
E39		Aaron	68
E40		Aaron	68
E41		Aaron	69
E42	Toboggan	Kyle	70
E43	Christmas	Kyle	70
E44	"Little Fights"	Kyle	71
E45	"Beauty"	Kyle	71

SECONDARY STUDENTS

FIGURE	NAME	STUDENT	PAGE
S1	Yacht	Carl	91
S2	Lady's Portrait	Helen	92
S3	Hinge Joint of Elbow	Helen	93
S4	Patterns	Helen	93
S5	Moon and Tree 1	Jane	94
S6	Moon and Tree 2	Jane	94
S7	City	Jane	95
S8	Brush Mirrors	Jane	96
S9	Sheep	Katrina	96
S10	Portrait	Katrina	97
S11	Flower and Window	Katrina	98
S12	Moon and Landscape	Katrina	98
S13	Lines	Joseph	99
S14	Dragon Sketch	Joseph	99
S15	Dragon	Joseph	100
S16	Skull	Joseph	100
S17	Warrior	Joseph	101
S18	Devil	Joseph	101
S19	Creature 1	Joseph	102
S20	Creature 2	Joseph	102
S21	Creature 3	Joseph	103
S22	Still Life with Jug	Margaret	103
S23	Still Life with Bottle	Margaret	104
S24	Mouth	Margaret	105
S25	Bearded Man	Margaret	105
S26	Hallway (Perspective)	Margaret	106
S27	Money Bag	Margaret	107
S28	Flamingos 1	Margaret	108
S29	Flamingos 2	Margaret	109
S30	Landscape 1	Kyla	110
S31	Landscape 2	Kyla	110
S32	Mountains	Kyla	111
S33	Ball and Square	Kyla	112
S34	Ball on Table	Lana	112
S35	Nesting Bird	Lana	113
S36	Birds	Lana	114
S37	Man's Face	Lana	115
S38	Geometric Forms	Marilyn	116
S39	Ball and Cubes	Marilyn	116
S40	Palette	Marilyn	117
S41	Seascape	Marilyn	118
S42	Turtles	Marilyn	118
S43	Sketch	Marilyn	119
S44	Dragon Sketch	Robert	119
S45	White Dragon	Robert	120
S46	Inverted Dragon	Robert	120
S47	Face with Hat	Sheryl	121
S48	Eyes	Sheryl	121
S49	Evil Face	Sheryl	122
S50	Mice in a Boat (Sketch)	Sheryl	123
S51	Portrait	Sheryl	124

CHAPTER ONE

Art Education & Computers

"The machine itself makes no demands and holds out no promises: it is the human spirit that makes demands and keeps promises" Lewis Mumford, 1934:6.

Introduction

Paint without water, pencils without lead, surface without texture, solvents without substance or odor, and infinite sheets of back-lighted paper. These describe some of the characteristics of an art room which relies on the use of computers. It seems difficult to imagine that such a transition, from tangible stacks of paper and canvas that have been worked over with various media, to this environment could be accepted as the result of nothing more than the introduction of a new tool.

Whereas the physical environment has changed somewhat with this new entry into the art class, more significantly there are changes which take place with the art piece itself. Its physical properties and its position in relation to its maker and viewer have all changed. Furthermore, how art is now assessed may or may not be similar to those types of judgements that were imposed upon more traditional art pieces. Under these circumstances even *accidents* would be understood in a new form since the computer image is protected from the world of the coffee stain and the accidents must now be allowed for in programming.

Computers are relatively new to the educational stage, yet have already had a profound and extensive effect upon the school environment. Drawing programs, drafting programs, graphics programs, and word/document processing programs have become common-place, with students not required to learn programming skills to utilize the computer for art any more than they would to use it for word processing. The packages and the hardware are already available and in place in many schools. On the other hand any real appreciation of

what to do with these materials is not.

This thesis is an inquiry into the perceived value of art making as it is experienced through the use of the computer. To a lesser extent the thesis is also an inquiry into the changes which occur as a result of divorcing human art-making from the surface of traditional art materials.

Computers in Education

In 1985, a total of 1,509 Alberta schools were surveyed in an effort to find the number of microcomputers that existed within its schools. It was determined that about 16,234 computers were in place as of January 1 of that year. It was further extrapolated that by January of 1986 at least another 8,143 computers would be added to make 24,377 (Alberta Education, 1985: 1-2). This figure begins to make clear the extent to which this province's school children are coming into contact with computer technology. And, there is a growing demand for all educators to increase their reliance upon and promotion of computer usage.

In 1985, school districts which were visibly active in educational computing issues were invited to attend a Strategic Planning Symposium set for January 29-31, 1986, in Edmonton. Dr. David Moursund, from the University of Oregon and Editor-in-Chief of the International Council for Computers in Education, prepared a special edition of his Strategic Planning Newsletter and submitted it to this symposium. In this newsletter he makes the following three recommended strategic decisions:

1. *Hardware and software acquisition and monitoring should become a regular part of the school budget.*
2. *Computer-related teacher training should become a regular and significant ongoing district commitment.*

Within this recommendation, Dr. Moursund states that school board administrations "should not accept recent college graduates who are computer illiterate" (p. 237).

3. You should establish a curriculum revision framework that facilitates major changes in curriculum content across all grades levels and curriculum areas.

Especially from this second recommendation, it is possible to catch the presumed intention that every educator and student will soon be involved in the use of computer technology. What follows is an assumption that these educators will also have an understanding of what they will do and how they will go about doing this.

The new curriculum guide for Secondary Art Education promotes the use of computers when possible in order to enrich the student experience of making art. There are no clear guidelines made available to art educators as to the manner in which this technology is to be applied or for that matter, how to utilize it within the principles of sound educational practise. However, this lack of direction is by no means confined to art educators.

In a study of computer use in Ontario schools, Ronald Ragsdale states that many educators "believe computers should be used in schools, but do not have specific reasons why this should happen" (Ragsdale, 1982:1). Such uncertainty may be interpreted in a positive vein as an effort to establish a working philosophy which emerges from the direct involvement and experimentation by schools.

Philosophies of computer use have not had time to develop along any clearly defined lines, the industry responding to fads and market quirks as much as to a sound progressive schedule of improvements. As the market becomes saturated with the novelty items, it is reasonable to assume that those companies that will survive long into the next generation of users will be those that can anticipate user needs on a more fundamental level. Interestingly, the proliferation of computers which offer complex graphic and image processing equipment has exploded recently, paradoxically offering the opportunity to do a tremendously increased number of things with the image while creating an even bigger vacuum of answers as to what should be done. Undoubtedly it is not the makers of this equipment who will decide upon its application. That task will fall directly upon the users and this includes educators and their students.

The industry has anticipated its own limitations on the personal level, people having a lower saturation and frustration level than the general business community. Hence computers are expected to be more powerful but less conspicuous, more accessible but likewise more transparent. A current advertisement of a well known computer emphasizes its small size, wherein it states that it provides maximum benefit while demanding the least from the work environment. This feature of minimal desk space is referred to as a small "foot print." The meaning is obvious and self-explanatory, yet provides a useful analogy for an investigation of the manner in which technology may be seen to infiltrate the world of people.

The notion of foot print is naturally a reference to the human foot which may be used to indicate in a two-dimensional manner the standing space required for an individual. The advertised necessity of looking beneath the computer to determine the degree to which it *interferes* with the human world is an industry-based recognition of the desire of the user to be concerned with the computer in a purely elective fashion. The consideration of the ultimate usefulness of the latest bit of high tech is first justified on the basis of it being held in check by not overstepping its boundaries. In other words, even in a commercial sense technological virtuosity is given second place to a consumer-perceived need to limit itself. Understanding computer use is concomitant with understanding human need and desire for technological assistance.

Educators who lack an understanding of the place of computers in schools (who, through no fault of their own, are certainly a majority at this point in time) are in a difficult position to develop strategies in the isolation of their classrooms. The most common means of dealing with this problem, whether or not it is the most effective, is from the administrative perspective, defining the needs of the school region and then calling in all possible forces to address these needs. Ronald Ragsdale (1982) notes that "the laissez-faire approach to the development of computer applications in education is not good enough"(p.94). He proposes that:

> Administrators should be concerned that the use of computers is introduced into the schools in a "coherent" way, so that the objectives of computer use do not conflict with other school objectives (p.95).

Ragsdale recognizes the problems in formulating such a coherent strategy and especially those which are associated with curriculum development. He states that one strategy to cope "with the uncertainty of long term prospects, is to make more systematic efforts to study the effects of computers on students, so that our educational curricula can take advantage of the positive effects and take action to minimize the negative effects" (p.95).

The purpose of my study is to contribute to the research of computer effects on students, especially of the manner in which the effects of the computer can be perceived in the working relationship students have with their art. The study is also concerned with in the ways in which it alters the understanding of what art and individually held skills are. Further, it is concerned with the pedagogical consequences that result when a technology based curriculum is implemented in a school environment.

Computers and Art Education

There is a great deal that might be said in a positive and enthusiastic manner regarding computers and art. Several recent motion pictures have been produced solely as a means of demonstrating the visual power of the computer-generated image, and, there is little doubt after seeing one of these marvels that the future of high technology will have a direct bearing upon the nature of art materials and their subsequent use. Computer generated and controlled music/sounds have already become well entrenched in the music industry which seems oblivious to the question of whether it is music in an historical context, content to know it is such in a contemporary understanding.

In a book called Trends in Computer Assisted Education, authors John Gardner and Robert Paisley have taken a look at Microcomputer Graphics in Art and Design Education in Britain. They declare that:

> Whilst economic viability is necessary to encourage wider acceptance of the computer perhaps the most important consideration is its educational viability. This educational viability must be based on two factors:
> - the attractiveness of the techniques to both teachers and students and
> - the relevance of the techniques to art and design education (Gardner, Paisley, 1987:78).

Gardner and Paisley speak easily of new materials, both software and hardware, and draw some conclusions regarding the advent of a new medium, the computer, which can enhance the stated objectives for Secondary Education in Britain. They look at the National Criteria for Art and Design which was published by the Department of Education and Science (DES) in 1985, and assess the criteria there established for the new General Certificate of Secondary Education (GCSE).

These criteria include:

(a) the ability to perceive, understand, and express concepts and feelings in visual and tactile form.

(b) the ability to record from direct observation and personal experience.

(c) the ability to form, compose, and communicate in two and three dimensions by the use of materials in a systematic and "disciplined" way.

(d) the acquisition and understanding of technical competence and manipulative skills, which will enable individuals to realize their creative intentions.

(e) experimentation and innovation through the inventive use of materials and techniques.

(f) intuitive and imaginative abilities, and critical and analytical faculties.

(g) the ability to identify and solve problems in visual and tactile form: to research, select, make, and evaluate in a continuum.

One of the growing difficulties in looking at the impact of technological change in the educational system, as with any potentially controversial issue, is the appearance of being fully for or opposed to only one set of arguments, i.e., not to be aware of other perspectives. Gardner and Paisley have opted for such one-sidedness in their article, suggesting that there really is little that the computer can not contribute to improving the art environment. They have taken each of the above points and pointed out how the computer is suited to its fulfillment. The unsuitability of some of their arguments can be understood from the following example.

In relation to criteria item (d) above they state that with computers the:

> user is actively encouraged to adopt a disciplined approach to the work both in the creative development of an image (e.g., picture framing, brush or tool size and shape, and so on) and in the technical management (e.g., file naming, disk management, and so on). Learning all the possibilities a package has for creative application in, for example, the use of patterning to simulate the visual texture of Aboriginal art ...is comparable to the acquisition of technical and manipulative competence in any aspect of a conventional medium such as clay or oils (p.83).

There are at least three questionable assumptions made in this brief statement. First, the suggestion that the user is "encouraged to adopt a disciplined approach" is misleading and presumptuous. The user is actually limited, more than encouraged, to deal with pictures in a technical manner. This point will be demonstrated in this study. Students must not only treat their work as files to be retrieved and saved in a non-forgiving system, they must also adopt a technical approach to the use of all so-called tools. The assumption is that such a narrowly regulated approach to art is indicative of artistic discipline. There is little basis for this belief.

Second, there is a reference made to students "Learning all the possibilities" of a package. This phrase is somewhat nonsensical since (a) the packages are only commercial packages sold for marketplace-controlled reasons that may not contain suitable sets of possibilities and (b) the computer environment is not limited in the same sense that a given tool might be limited. The search for all the possibilities may be of infinite duration.

Third, it is proposed that the use of patterning to simulate texture is comparable to the acquisition of technical and manipulative competence in any aspect of a conventional medium such as clay or oils. The example they use is of a Macintosh computer image showing a reproduction of Aboriginal bark art. This statement is simply not true. The technical competence of an artisan working in clay reflects craftsmanship, a manner of controlling and interacting with of the material that transcends mere mechanical reproduction. Furthermore, the use of computer-regulated, simulated textures is not comparable to actual texture. And the example they chose to base this argument on most clearly demonstrates the differences. The Aboriginal work of art was religious in nature (insignificant?), constructed of actual tree bark with pigments that were hand-ground (software variable?). Finally, the Aboriginal painting was created from personal and cultural experience, the patterning of the computer can be selected from a list of built-in textures. Selection is not comparable to creation.

There are many examples of the manner in which the computer is held up as a substitute for personal experience. The question arises as to whether it is necessary to think of the computer as a replacement for art experience, rather than a contributor to the student's experience? One of the purposes for which this study was conducted was to ask whether there is necessarily a conflict between the realization of personal artistic need and the utilization of computers in its pursuit.

While general educational trends are clearly leaning on (if not jumping into) a close association with computers, overall art educators have tended to look the other way. This reluctance on the part of art educators can easily be misinterpreted as simply a reluctance to join the crowd because of an inability to either participate or comprehend, but other more positive rationales are probably closer to the truth. It seems wiser to assume that a general and widespread caution is indicative of a perceived, if not articulated, suspicion of what's inside the box. After all the fine arts, in a manner similar to some other curricular fields,

claim a primary interest in the value of the endeavor of the study, rather than an accumulation of the contents of that which is studied.

Although art, in popular and educational terms has primarily been the instruction of techniques (Nadaner, 1983/84; Chapman, 1982), the fundamental objective of art education is not the pursuit of methods, instead such instruction has provided the vehicle for daily in-class learning. In line with this there exists a variety of rationales which are both unique to art education and often parallel to general educational aims.

Art making is innately concerned with technique as a means of allowing the artist to associate with specific materials or ideas. These techniques are seldom the primary focus of the artist but may become the focal point of instruction; learning remains the responsibility of the learner. In other words, techniques may be taught while application of these techniques is left to the user's discretion. When the learner, or artist, elects to acquire only the technical virtuosity of a given craft then the dynamics of the person/craft association are affected; "How to do" replaces "How to be." Yet , overall, there seems to exist an understood balance. An art teacher may very well operate in a largely technical environment while demanding involvement and personal expression on the part of students. The use of tools is understood as being secondary in importance to the whole enterprise. The possibility exists that computers can threaten to upset this balance by making instrumental use paramount and the experience of the child only a factor to be accomodated within the curriculum when possible. If the place of the child is not articulated within the curriculum, understood meanings may be inferred from elsewhere, meanings which may be in conflict with sound art educational rationales.

Broadly speaking, while science tends to value technology for the result - the ends, art tends to value technique for the experience - the means. But with the loss of experience, mere technique reduces art to image. There is a great deal of uncertainty as to what the function of art in schools should be and the tendency to abdicate the sometimes abstract human issues in favor of the technical is very great.

Certainly expediency is regarded as one of the requirements of this type of undertaking. Computer drawings, photography, silk-screening, or mold work can all be used for expediency. In fact each lends itself to this approach, while possibly sacrificing the intent of conducting the task (i.e. experiencing the activity) in the first place. The tendency to follow this rationale is already rooted in those curricular demands, which require the arts to fulfill needs that are really external to an arts intention.

For example June King McFee (1970:87) asks "what can we as art educators do to begin to deal with these problems (general social unrest, minority group needs, sub-cultural diversity, media manipulation, social isolation) as we try to cope with the education of all children and youth?" Such has been the demand upon the arts in this form especially since the 60's. Other demands have been for art educators to take a stand on social-political issues (Lanier, 1976).

If the case can be made that art is to be in the service of socially defined needs, it would then follow that its intent is to serve these needs in the most expedient manner. Where the message is deemed to be essential the possibility exists that the human element could then be regarded as not necessary to, and possibly obstructive to, the realization of the art statement.

Jasia Reichardt (1971:81) writes of attempts to utilize highly technical means for personal expression. She suggests the approach to the making of art is subject to the intent of the artist. In attempting to isolate the artistic understanding of some "computer artists," Reichardt points to the computer work of Masao Komura who states that it is possible to duplicate the style of any artist.

> Let us suppose, for instance, that oil paints and canvas are selected, and a palette knife to be used in Fauvist style. Now that we know this, the precise content of the resulting painting is not of such great interest, whether the subject be an apple or a person with a melancholy face... I should like to propose the thesis that art is the discovery of a system (Reichardt, 1971:81).

Art is here presented as pure technique, unencumbered by personal interpretations or individual expressions. Where such thinking is supported the computer will certainly present no problems, though such an application is but one manner of considering the technology. This conception of art does little to further our understanding of what art means to the individual or the place of individual experience in the realization of the arts.

John Dewey (1916) considers experience as an active-passive affair (p.164) so that one involved in the art experience cannot simply initiate the procedure, but must actively participate in it. "A separation of the active doing phase from the passive undergoing phase destroys the vital meaning of an experience. Thinking is the accurate and deliberate instituting of connections between what is done and its consequences" (p.178). Reichardt's definition of art fails to maintain the integrity of this human involvement in the making process.

Dewey states that the 'unknown' quality of the experience substantiates it. The very purpose for which the computer may often be applied would lie in opposition to this notion. Control, expediency, reliability, and certainty are terms easily applicable to computer use.

Where information transfer or product is the desired end, efficiency is justified. When human experience is held up as essential, the use of technology becomes questionable. Artistic experience is first human experience and can be justified in any setting, including the technological, provided internal (people-centred) priorities are not established as lower than external (task-oriented) ones.

Whether art teaching generally occurs for purposes of technological primacy or human needs is not yet clear. Using the computer to make art because it is faster or easier is certainly a questionable practise in need of clarification, while justifying the art experience with technology based on decorative or compensating, i.e. pacifying, rationales is likewise weak and damaging. The need is for a sense of asking for possibilities, for assuming an appropriateness in exploration and personal expression. If art educators fail to assert a

strong commitment to defining an appropriate manner in which to interact with computers such a role will be defaulted to them, one in which the functioning of image processing and manipulation is predefined as a result of corporate and commercial need. The situation is not new to art educators who often find themselves justifying their programs on the heels of general school trends rather than basic student needs. Art educators have sometimes allowed the integrity of their educational specialty to be compromised due to a lack of certainty as to what rationales are expected of their field (Chapman, 1982).

It would seem necessary at this juncture in art education to investigate the human dimensions of child/computer interactions, to attempt to understand the problem from the perspectives of the children who experience the art activity through technological means. Investigations should also reflect the assumed position of the curriculum in attempting to gain a measure of control over the experience.

Computer use may very well be an exciting and rewarding addition to the art experience, and may be pedagogically appropriate, but only if it responds to the needs of the individual. Redefining what students must do so that they fit the limitations of the computer has no merit within the art educational experience.

Statement of the Problem

The pertinent issues of the present study consist of an attempt to acquire an understanding of the significance computers imply for art education. Such an inquiry is long term and would exceed the capabilities of any one researcher. Yet, contributions to the inquiry can be made. One means of attempting to contribute to this broader question could be accomplished by examining the lived experience of children who use computers. Concern must be shown for pedagogical issues which result from this utilization ostensibly for art learning, and a questioning of the values implied or denied in a technological-educational environment.

Investigating the priorities and interpretations of curricular needs according to actual teaching denotes suitable methodologies which might provide for the revealing of the hidden concerns of teachers and students. The students themselves will assume their own association with computers. These associations may or may not coincide with official intents. Into this human redefinition of computer use, whether inside or outside of the classroom, remains very much controlled by the limitations imposed by software and hardware. Within the schools the allowances and encouragements of the educational system will also necessarily tend to establish levels of understanding.

It seems necessary to investigate the human dimensions of child/computer interactions, if we are to attempt to understand the problem from the perspectives of the children who experience the art activity through technological means. The focus of this study are these child/computer interactions, and the question to which it is directed may then be stated as:

What, according to students, is the perceived value of the art making experience which utilizes computer technology?

This main question demands of the study an examination of the manner in which students can establish a sense of interaction between their understanding of art and the utilization of the computer. The main question is answered through the formulation of two other sub-questions:

1. How does computer use affect the child/art relationship?
2. What issues and concerns are created for art educators as a result of this relationship?

It is not possible to simply ask students what they think of this experience for a number of reasons, each of which is sufficient to prevent a valid response.

First, students will most likely not know the answer. The computer brings with it such a wealth of possibilities that no conclusive statement is really possible from these students

based upon their limited time on the computer. Longer involvement on the computers by these students might be desirable from a researcher's point of view, but this is highly impractical in reality. Class involvement in suitable computer use on a regular long-term basis, though growing, is almost non-existent within the present school system.

The second obstacle to direct student response is the nature of the experience itself. Art students cannot possibly be fully describe an area of their curriculum that is extremely elusive in definition even to its professional educators. The nature of the creation and worthiness of art is not easily deciphered. Even the most committed students can not hope to have a complete understanding of why they make art a particular way, or what the best tools are for its expression.

The third obstacle is the newness and changeability of the computer technology. Any response would be case specific, based on a computer type, a specific software package, and the particular understanding and expressive needs of a given individual. These factors combine to necessitate an inquiry approach which allows students to explore the computer as much as possible on their own terms.

The Means of Inquiry

Two schools were selected for this study in order to gather the impressions and reactions of elementary as well as senior high students. The selection of the two schools was determined as much on availability as any other factor. This selection was considered of limited significance to the nature of the study for the following reasons.

At the elementary level all students in all schools are equally considered to be art students, the elementary curricula providing for the expressive needs of all students. It is therefore not necessary to question whether one group of students of this age are more appropriate than another. All students are inherently capable of, and in need of, expressive outlets. The deciding factor at the elementary level is the availability of graphics-capable computers on a regular basis. Through consultation with the Supervisor of Art for the

Edmonton Public School System, it was determined that one particular elementary school was engaged in exploring the use of computers in a variety of ways, from word-processing to graphics use. This school was using the Macintosh computer and the MacPaint program.

Students in this district who have been noted as "high-achievers" have sometimes been given long-term access (one year) to computers for a variety of reasons that are thought to compliment the educational growth potential of these children. This situation often exists in spite of the fact that there is no well reasoned curriculum for these students to follow. Teachers are not reluctant to remark they are uncertain what good is occurring. One intent of this experience was the utilization of the computers for graphics (drawing). Programs which are designed for drawing are readily available, providing an existing group of students who are experimenting with the artistic utilization of the computer.

A number of students in this school were experimenting with the computer, some on almost a daily basis, others with much less frequency. Six students, two in Grade One, two in Grade Three, and two in Grade Six were using computers about three times a week for forty minute periods. Due to the flexibility of the elementary schedule, in reality, these classes sometimes ran for an hour, as well as suddenly finding that there was an extra class or two per week whereby students could put in extra time. These students were declared as superior students in their school work and academically superior to many of their peers. Other students who periodically used the computer for short sessions.

No set number or type of assignments was given to these students by their regular teacher or the Principal. Students were instructed only to explore the drawing program, with some demands for a drawing of a particular theme to be presented on occasion. There were many "fool around" days provided so that students could determine what the subject matter was for that day. Even on occasions when subject matter was predetermined, the application of the computer was still a student decision. This student freedom to choose was as much for reasons of teacher non-involvement in the computing process as for any

other. The Principal, in whose office the computer resided, was almost always in attendance for at least half of the class time. His instructions to the students were always of a technical nature in terms such as how to select on the screen, how to move the mouse, and how to initiate the print procedure.

I attended this school on an almost daily basis for four weeks, audio-taping each of the class periods. The students, usually in pairs, sat at the Principal's computer table, with myself sitting either at their side or behind them, facing the computer screen. The atmosphere was relaxed for the students who regarded the Principal as very approachable and understanding. He had instructed them to use the computer freely and to please accept my presence there as that of another student, an older one from the University who was looking at the types of drawings students made on the computer. It was stated that I was not a part of the school administration and would not be marking them for any of their work. They were doing me a favor by letting me witness their work.

The selection of a senior high was again assisted by the Supervisor of Art, who has encouraged an increased involvement for students in the use of computers. The Supervisor of Art informed me that one particular school had just been awarded $70,000 worth of computers (16) and a laser printer from Apple Computers (Canada) which had made this gift to six schools in Canada. Such a well equipped lab provided a unique opportunity for observation of student experimentation with a form of technology that was very new to them.

After consultation with the art teacher in this school it was decided that interested Art 30 students would be given the option to use these new Macintosh computers daily for two weeks. These classes were held in the Computer Lab, a science room which had been converted into a computer room.

After it was determined that almost all students had not had any prior experience on computers I spent a part of the first class showing the basics of the computer system and how to select options in the drawing program. By coincidence there was almost always

present a student, not from the Art 30 class, who was considered the open source of assistance on all Macintosh technical matters. After this introductory time, students were given the opportunity to experiment freely.

Requirements for these two weeks included:

1. Attend this class or the regular art class. Attendance was taken.

2. Attempt to put the computer through its paces to determine what types of work they found most suitable.

3. Hand in examples of all work, regardless of its quality or their satisfaction with it.

4. Save examples of all of their work on a separate disk.

5. Submit a questionnaire response, a personal essay giving an appraisal of the experience, and participate in a group discussion at the appropriate times over the two weeks.

The Art Teacher told the students and then myself that I would give them marks for the time spent on this work. I informed the students that the only criteria for marks was sincere involvement. All students who attended the classes and were involved in trying to use the computer, regardless of output and regardless of their perceived quality of their work, would get full marks. Involvement and no other factor was to be considered just as important. I went as far as to state that completely negative responses were to be considered as significant and as appreciated as those of a positive nature. The students were engaged in an investigation of the suitability of the computer to their art.

I attended the school every afternoon for two weeks. If asked, I would assist any students to utilize the computer. Very few of these requests were actually made to either myself or to their peers. These students were very independent in nature and willing to accept the experience in a positive exploratory frame of mind. The findings of the study were evaluated to determine what, if any, effect computer use will have upon the aims and objectives of current art educational practise.

Limitations of the Study

In order to develop a workable approach to the question of computer use in art classes it is necessary to limit this study in a number of ways. First, this study is limited to students who have access to the Macintosh computer in a school setting. The Macintosh computer is one of the most sophisticated graphics-capable computers found within the general school system at this time.

Due to the fact that these computers are not yet widely available to all students, the students in this study must be seen as being of a somewhat atypical group.

Second, the study is limited to the analysis of images which are created on the Macintosh computer using the MacPaint program, the Apple Macintosh program being sold as a main drawing program for this computer. Whereas it may be possible to extrapolate from the findings of this study in order to assess the value of the relationship students have with computer technology in general, such extrapolation is not the intent nor the purported outcome of this investigation.

Third, this study is limited to the open exploration of the aforementioned hardware and software, not to a prestructured curriculum.

Definitions

Computer Graphics - Images or icons which are created for display on a computer monitor. These may be drawn with a computer drawing package, or may be acquired through various external means such as digitizing equipment or from other media. The resultant image may be edited infinitely with a drawing program.

Pixels - In practical terms a pixel is the smallest visible unit of light identifiable on the computer screen. In other words, it is the smallest component of an image or picture. The Macintosh screen consists of a 512 pixel by 342 pixel display. Another way of thinking of this would be to consider that an image

on the screen could be described with a maximum of 175,104 points or pixels, which allows for a great deal of detail.

Simulation - A computer simulation is a programmed replication of specific factors found in the actual world. All simulations are therefor compromises at best, but often useful in allowing the user to better visualize the consequences of an action taken within the context of a predetermined set of circumstances.

Software - Computer software are instructions or programs for the computer to follow. Since the computer is totally reliant upon software for all of its functions the suitability and integrity of software will always be a significant factor in the usefulness of the computer for any task.

System - Webster's Ninth New Collegiate Dictionary defines a system as "a group of devices or artificial objects or an organization forming a network esp. for distributing something or serving a common purpose." Within the context of this study the meaning of system is comparably used to suggest the role and function of a computer may be considered as one of the devices that contributes to the communication of ideas (concepts, images, etc.). This differs from the notion of computer as tool.

Tool - A tool is an instrument or apparatus used for the execution of a task. As an instrument the tool may bring the task to its completion. On the other hand a definition of a computer as a system implies that it is only one of the contributors to the completion of the task. The other contributors include the software, its programmers, and all related hardware. The computer may best be considered a tool rather than a system only if the programmer and user, in concert with the computer, are minimized.

CHAPTER TWO

Background to the Study

Technology and Art Education

In North America the growth of contemporary art education was initiated for largely industrial-technological reasons. Early attempts at competing with the textile industry of Europe showed the need for industrial craftsmen who could give America a competitive edge (Eisner Ecker, 1966:10).

Exercises in the art classes, which were primarily drawing classes, at the time of the late nineteenth century consisted mostly of copy work to provide a sense of the classics and a technician's hand (ibid:10). The role of the artist as a fundamental part of the business community was justified by the contribution of this worker to the labor force.

The intervening years between the mid 1800's and today saw art education accept and promote drawing as a part of the curriculum for a number of reasons, including the training of eye-hand coordination, cultural enhancement, child-centered needs, the education of 'good taste,' the development of creative thinking, and the education of aesthetic consciousness (Plummer, 1977) (Keel, 1965:35). The demands were sociological and certainly devoid of a phenomenological concern in respect to artistic expression.

Technological society demands trained workers. As such, its school structures tend to address a future need, with an emphasis on activities as purely instrumental and preparatory. Elliot Eisner (1972) makes this point in suggesting the weaker functions of art lie in what he has termed its contextualist capacity (p.2). This necessity to constantly address the non-immediate can result in the belief that all experience is not truly worthwhile for itself, but only for what long-term benefits it may anticipate. Activities that are not instrumental may then be shown as deficient and with diminished meaning.

Teachers of art are aware of the dissonance that exists between the purported rationales of their field and the manner in which they are actually assessed (Chapman, 1982). An

awareness of socially defined pressures to equip students for specific purposes, while stating a belief in a set of values that may conflict with these same purposes, is not unusual.

There is an intrinsic drive to have all school-based curricula respond to the perceived need to accomplish more, and at an accelerated rate. Art teachers, as eager as other professionals to promote the aims of the school system, find their goals shifting from a student-centered to a school-centered approach. Developments in technology have raised the possibility that there may exist better ways to achieve the goals of the art program, and to establish a greater sense of community respectability in the process. If art students are using computers and acquiring advanced skills in their use then it is easier to place a judgement on the outcome of the class experience.

Partially as a result of these influences art classes are generally technical in nature. But of course this is only a reflection of socially defined direction. The roots of contemporary Art Education extend as far back as our conceptions of art and craft. The practise of training and apprenticing young artisans required long years of dedicated effort, much of which was spent in the acquisition and perfection of identifiable traits of quality in the workpiece. These were regarded as indicators of craftsmanship, and their vehicle for reproduction was technique.

In the pursuit of pertinent, legitimate art practises art education has referred to the work of professional artists, both past and present. Almost instinctively their techniques are analyzed and then copied by students who hope to benefit from their special insights. With the growth of institutionalized design centers art could be viewed as a body of knowledge that might be understood and taught under clearly defined rules. The Bauhaus, in Germany, was a technological milestone, gathering together a collective effort to put rules on design and designs on art. Dan Nadaner refers to the Bauhaus as constructing "a democracy of the technological" (Nadaner, 1984:26). Its influence has been spectacular and today "the design elements make up the most common course content in art education" (p.26).

Rooted in technological reasoning, the design elements are the scientific explanation of how aesthetics operate. These elements tell us what it is that makes us respond the way we do. "The design movement gives its first allegiance to technology, and fits its aesthetics within technological limits" (p.26).

Technique in Art Education

Technology and art are historically rooted in the human spirit as that which seeks to ask new questions and to express the human need to define a personal place in the social/physical landscape. Jacob Bronowski suggests that art, like science, is an aspect of humanness that provides for a forward looking possibility - the opportunity of asking "What if?".

> Art and science are both uniquely human actions, outside the range of anything that an animal can do. And here we see that they derive from the same human faculty: the ability to visualize the future, to foresee what may happen and plan to anticipate it, and to represent it to ourselves as images that we project and move about inside our head, or in a square of light on the dark wall of a cave or television screen (1973:56).

Conventional perception generally holds the truth to be other than Bronowski's, instead encapsulating both art and science as polar opposites, neither representing humankind as much as reflecting commercial and technological/industrial need. The connotations of the terms changed within a few historically short periods.

Ronald Bruzina writes, for example, of the historical shift in the meaning of terms which describe the act of producing art and architecture. He describes the manner in which our present-day understanding has combined the ancient terms for that which is a human centered skill (Gk. *tekhne*) and that which is a purely mechanical operation (Gk. *mekhane*). When this shift occurs in practice there is little room for an essential distinction between what a machine, e.g. a computer, and what a person, might accomplish.

The Greek word *tekhné* is translated as skill, art, craft, or technique. For those circumstances whereby the individual was obliged to attempt to alter that which was natural or native to their own personal sense of control, a device or machine (*mekhane*) was used. Thus the terms tekhne and mekhane implied different approaches to the task of making.

There is a shift in meaning from the Greeks, and from the Renaissance, which reflects our tendency to separate that which is artistic from that which is technical.

> In the modern conception, *tekhné* , rather than being a general ability to make things intelligently in a broad range of particular skills including architecture... has now come to mean strictly *an instrumentality of a particular sort* , namely, that which can be separated from the specific context of human experience and sensibility as operative in making, in order to attain neutral, objective completeness and clarity on its own - to become the *merely* or *purely mechanical*. (Bruzina, 1982:167).

As Bruzina points out, the ancient terms *tekhne* (Greek) and *ars* (Latin), are used to name the technical and artistic modes of making. But to what extent are these terms reflective of our present conception of making? Continues Bruzina:

> For in the end, we will have to face the question whether anything of this pre-modern character of making still subsists in our work today, or if it does not, whether and how it should if that work is still to be considered a *human* enterprise (Ibid.167).

Present terms having a genesis in the Greek *tekhne* and which have undergone a transition in meaning include the grouping of *technical, technique* and *technological* , as if all are synonymous. Bruzina recalls Lewis Mumford's use of technics as an attempt to retain something of the classical sense of *tekhne*, an attempt to seek a term which helps clarify the place of art as a human endeavor.

Don Ihde explains the Heideggarian position that technology, while ontologically prior to science, is historically later (Ihde,1983:30). This perspective accepts the understanding of technology as a human-centered endeavor. Extrapolating from Ihde, it might be said that, while ontologically prior to technique, art is historically later, e.g. that aspect of our

making which is referred to as art may be viewed as a formalized outcome of a human need to physically piece together the imagery of our self-awareness.

Ihde points out that, "techne is the human-world relation as mediated by the instrument" (1979:xii). Again he refers to technics as "the human experience of technology" (1983:vii).

States Ihde:

> Technics is not a new word... it conjures up a sense of *action* and *artifact* which I believe important for a focal understanding of technology. Technics stands in between the too abstract "technique" which can refer to any set action with or without a material object, and the sometimes too narrow sense of technology as a collection of tools or machinery (p.1).

Art With Machines

In an article which appeared in Electronic Learning, author Deborah Greh suggests that the function of the computer in art is one which allows the indecisiveness of students to be assisted by a more precise machine. She states one of the advantages of using computers in art is their suitability for dumping mistakes. States Greh, when using canvas or paper, students will often "...work a concept to death trying to rectify mistakes...There are no such problems using the computer...If an idea is unsuccessful on the computer screen, the student simply erases it" (Greh, 1986:30).

The author believes that students are best helped by promoting the execution of their work. She makes the assertion that as "a result, students using a computer are more prepared to take artistic risks than those students working in traditional media" (p.30). Greh sees the computer as a means of bridging the gap between the capable students and those who feel intimidated by a lack of art skills.

The School of Visual Arts in New York has recently instituted a Master of Fine Arts Degree Program in Computer Art. Part of the Director's Statement appearing in their catalog states:

> Collaborations between art and technology have occured throughout history but few eras have provided such strong motivation for this cross fertilization as the present. Computers not only provide unprecedented capabilities for artists, but artists must provide unprecedented amounts of information for this technology, information accumulated by artists over centuries (Gerbay).

Camera technology, to Susan Sontag, has revealed an aspect of each of us that demands ever greater numbers of images, in order to replace those to which, through extended exposure, we have become anesthetized. As these exposures are increased, the numbing effect, or at least saturation effect, seems to intensify so that after a while certain types of images no longer stir any emotions within us. The drive still remains and the wish to encounter fresh images inclines us to look towards technology for what it might offer. Verene refers to this as *technological desire* (Verene , 1984).

We may turn to technology in search of that which we feel eludes us. Sontag proposes the "reason for the need to photograph everything lies in the very logic of consumption itself. ...As we make images and consume them, we need still more images; and still more" (Sontag, 1977:179).

Where once such images were limited, and we were required to make more if needed, now the situation has changed, so that the marketplace, electronic and otherwise, is flooded with more than we can ever hope to absorb. Along with these of a photographic nature, computer images are readily available. Prepackaged computer disks which contain hundreds of already drawn pictures (Art Disks) can be purchased, or copied, to allow everyone access to the same degree of illustrative filler.The redundancy of images is one insult to the senses. Another is the uniformity of style and concept. This is to a large extent the result of the restrictive use of materials and a reliance upon easily reproduced line drawings.

These materials will easily filter into the school environment, much like the mimeographic horn-of-plenty has. The issue needing closest scrutiny is in the realm of application of these materials, whether they are referred to as samples, or held up as

examples. Presence seems to be 90% of acceptance in these cases, or as Sontag has stated in reference to photographs, "Time eventually positions most photographs, even the most amateurish, at the level of art" (1977:21).

An Art Education article called "Creative Computers: Premises and Promises" by William Squires takes a questioning look at the concept of using the computer for the making of art.

> ...in the case of artistic expression, the computer offers little. Creativity involves attitudes, perspectives, moral judgements, imagination, and intuition. Mastery of any of the arts is neither reducible to nor demonstrable in terms of a behavioral performance either by man or machine (Squires, 1983:21).

So, to Squires, the question is not just one of the accompanying visual material, it goes deeper to a question of the methods that can be employed.

John Gardner and Robert Paisley, on the other hand, make a brief statement regarding the suitability of computers for art, including the possibility for tactile expression. They state:

> Computer graphics can be shown to offer opportunities for visual expression but tactile expression is only achievable when the computer is linked to a physical extension such as a lathe or other machine-tool or perhaps an animated sculpture or drawing device (Gardner, Paisley, 1987:79).

They may help to promote a concept that is greater than the one they allude to. The joining of the intellectual aspect of the machine with mechanical muscle seems almost obvious, complete. It may be that we have spent too long examining one part of the mule because that is all which has been presented to us at this time, while the rest of the beast awaits attention. The computer's power lies in its ability to process complex instructions and then to direct an output subsequent to the analysis of specific options. With the development of more creative means to allow for the interpretation of ideas it becomes possible to harness its muscle as well as its data processing power.

The following artists, all of whom use computers in their work, provide an insight into the attractiveness and suitability they find in its use. Artist Gerald Hushlak uses the

computer and plotter almost exclusively for his 'paintings' because it allows him to exercise a greater degree of freedom in his work than would otherwise be possible.

> From the art point of view I guess what it does best is provide instant visuals which enable me to see tangible images for what would be visuals conceptions - if I didn't have the computer these would merely be ideas. ...I guess the computer allows me the freedom to go off on tangents and not feel guilty because the original imagery is stored in the system (Hushlak, 1982:5).

Ben Laposky attempts to maintain the scientific interpretation of the environment as much as possible. His pictures are modified variations of oscilloscope readouts with no pretense to mask this source. He feels the art work is still very much his own as he is the instigator of the readout and has defined the conditions in which this art might be created.

> My work in computer art is a form of oscillography, the results of which I call 'Oscillons' or 'Electronic Abstractions.' ...Objections are sometimes made that this and other kinds of computer art are 'machine art' - cold, impersonal, even inhuman. In some cases this may appear to be so, but it is obvious that the machines or instruments that form them are the products of imagination and planning, and at some previous initial point, the work of human hands. The output is conceived and controlled by human intelligence, and the results evaluated by personal aesthetic standards. If the computer is to produce art, it seems to me that the ability for it to do so must be programmed into it (Laposky, 1976:21).

Leslie Mezei takes a somewhat critical view of art on the computer, expressing her belief that while it is both suitable and worthwhile, far too much talk about its potential has been allowed to masquerade as visual proof.

> What we ask of the artist is to use the science and technology to explore and expand our reality, and make statements of significance to today's tortured but expectant world. We have all filled pages and pages of programmatic notes, enough aims for a lifetime. Now it is time to raise the standards, to stop applauding the fact that we can do art with the aid of a computer at all, and apply as critical judgement to our results as to any other works of art (Mezei, 1976:23).

Mezei has made an attempt to look in a fresh manner at the new technology which she believes must be addressed in new ways.

> We need those things which uniquely suit these new media, which can only be expressed with their help, and this makes the effort worthwhile. I look for the fresh wind of ideas from the new wave of art students who will be literate in the information sciences, and conversant with interactive computers and the new processes which they can help visually explicate (Mezei, 1976:26).

Although Tony Longson uses computers, he is mostly motivated by issues of sight. Earlier explorations into the phenomenon of sight and ways in which to manipulate the viewer's comprehension of the environment led him to investigate various computer-generated images. Longson sees a number of short-comings in computer use, believing it can best be maintained as a component in the creative process.

> The limitation is this - a computer needs to have the problem closely described, and there are ingredients of creativity which cannot be described. ...At least I am learning more about my own working methods - at best the computer may assist decision making in a naturally creative way (Longson, 1976:29).

Ann H. Murray has placed the emergence of the computer as artists' tool into historical perspective, recognizing it as a development of the desire to know further the relationship between elements such as colors and lines on one hand and the human psyche on the other. The locating of the computer in historical terms will only become clear in time and would be best regarded as an approach that must be researched with an open mind.

> In many respects the utilization of the computer for artistic endeavors parallels the emergence of photography as the 'mechanical medium' of the nineteenth century... Only after the photograph was accepted at the level of an artistic aid could it ultimately cease to threaten painting and develop into a creative medium in its own right.
> Much of the computer-generated graphic work to date must properly be considered as the groundwork for a similar type of development toward an autonomous artistic medium (Murray, 1976:3).

Aldo Giorgini's work is so computer-oriented that he sees it as somewhat ridiculous to attempt to develop it otherwise. His work is highly mathematically structured with a strong reliance on several programs that he has helped to develop.

> Yes (my work could be done without a computer), in a fashion analogous to the one of carving marble with a

> sponge. Since all FORTRAN instructions could be performed by the other techniques, there is no doubt that one could execute the same by calculating and drawing by hand on a Cartesian plane. The difference between the two approaches lies merely in the amount of time required for the execution of the piece (Giorgini, 1976:12).

Aaron Marcus has, like Giorgini, created an art form that is now highly dependent upon computer use. Marcus' form consists of images drawn on the computer which are varied and almost narrative in presentation.

> The computer is a tool for the simulation and stimulation of realities... I do the essential conceptual work and all of the programming. My computer-assisted works are definitely related to non-computer art, both mine and others, especially work in conceptual art... Some of my work could be done without the assistance of a computer, but it would be very time-consuming and difficult (Marcus, 1976:13).

Colette and Charles J. Bangert are a husband and wife team who use the computer together, make pictures, and sign the work as CB. They use the computer drawing instruments in much the same manner they might use pen and ink, but recognize that restricting computer use in this manner is mostly a limitation of that results from collective inexperience with the computer-as-tool. They feel the possibility exists to develop a new, more suitable means to engage the computer in the long run ("the Chinese artist took a life-time of understanding in order to make one meaningful ink filled brushstroke").

> Without conscious understanding of what a drawing is we could not use the computer as a drawing medium... Computer drawn lines enrich my hand lines which in turn enrich my computer drawn lines... Jeff and I use the computer as a traditional drawing medium (CB, 1976:20).

Joseph Scala accepts that the computer is a tool, but then recognizes that its function surpasses that definition. There is more than a tool implied in its use.

> The computer is definitely a tool for the production of art but it is more than just a tool. It is a new way of communicating between persons and the technological environment. The computer is the electronic interface between human thought and aesthetic expression which will allow human kind to tap and communicate those cords of humanity necessary for the continuation of human existence with and in our scientific-technological culture (Scala, 1976:72).

Duane Palyka recognizes the simulation of traditional materials and concepts through programming.

> One can have the computer simulate a traditional art medium with which the artist is familiar and leave it to the artist to make the transition from the medium he knows to the new medium on his own terms (Palyka, 1976:62).

An interesting point raised by Palyka is the introduction of original art works into the hands of anyone with a compatible computer system, doing with the computer as they wish and therefore allowing any person to access the techniques of the few (p.62).

> If one considers the question as to which medium is preferable - the computer or paint-and-canvas, the answer ultimately lies with the individual. Exciting works or boring works can be produced in either medium (Palyka, 1976:64).

Palyka believes the nature of the artist is to assert human traits into whatever work he or she might produce. These traits will exist just as surely in the machine environment as they do in any other.

> The artist likes to break rules if he can. He wants to disprove the seemingly absolute (Palyka, 1976:64).

This rebellious nature is also accepted sociologically as a means whereby humankind reacts against the social constrictions that have been imposed by themselves, asking new questions of old truths, and stripping the cultural veneer back as far as possible. "Art has historically helped to provide a means of turning away from social values that may be in conflict with personal values" (Gablik, 1984:10).

Ken Knowlton observes that the traditional means of approaching the art work is altered with the introduction of the computer. The immediacy associated with paint and canvas gives way to a sometimes very circuitous method of programming for visual results.

> Works of art are produced by the use of tools and materials; brushes and paint, hammers and chisels and stone, torches and slabs of metal. Some sets of tools are more complicated in function and use, and in some cases the end product exhibits a corresponding or resulting complexity. ...by watching the programmer work, I can scarcely begin to

> anticipate the nature of the result - I may not ever be able to guess whether sounds or pictures are the goal.
> It is the degree of remoteness between the inspiration and the product which I think characterizes computer art more than other kinds; the long and devious way that thoughts and feelings and purposes map into human actions, the way that these actions rigorously define mechanical procedures, and the complicated way in which these in turn produce the results (Knowlton, 1976:56,59).

Manfred Mohr observes the tendency to suspect the technology as a possible threat to human needs.

> The fundamental view that machines should not be considered as a challenge to humanity but, like McLuhan predicted, as an extension of ourselves is the basic philosophy involved with technology.
> A technology which 'functions' has to be integrated in our lives like a physical extension - a necessity of our body and our mind. We are living now in an era of enormous technological transitions, where so many misunderstandings in human machine relationships are created by lack of knowledge and the categorical refusal to learn by most individuals. A quasi mystical fear of an incomprehensible technology is still omnipresent (Mohr, 1976:92).

Hiroshi Kawano:

> A computer can produce its own works of art by representing the logic of artistic procedure which is hidden in human art. So this representing process is called the simulation of human art by the computer. But the computer's ability to simulate art is given by a programmer who lets the computer produce works of art by teaching it the algorithmic procedure of art as a program (Kawano, 1976:112).
> ...an 'art computer' cannot simulate a human art until the algorithm of art is found and described as a program. But this algorithm of art can be made clear only by scientific aesthetics (ibid, p.112).

Questions of a Social Nature

According to William Barrett (1979) we have reached the point where the difference between technique and technology has become meaningless. In fact, Barrett suggests that the assimilation of the two terms has established itself as "the great fact of modern history"

(p.21). Barrett notes the words have combined to put us in the position of dealing with "the single phenomenon indicated by the hyphenated technique-technology" (p.21).

Barrett indicates that any piece of technology can be realized as a set of decisions or programmed operations that are contained in the functioning of the machine. He concludes that since each piece already contains a set of refined techniques, "technology is embodied technique" (p.22).

If technique and technology have indeed become inseparable, this would imply that the user of technology also uses its embodied techniques. As a result, there would exist a lessening of the importance of individually held techniques. The machine becomes more than the means to the accomplishment of an external task. It would also serve as a vehicle to a more externalized aspect of our own being. "A machine is, logically speaking, an embodied decision procedure" (p.23).

Joseph Weizenbaum has also pointed to the same type of phenomenon, stating that the machine, here the computer, tends to redirect human thinking. "I have argued that tools shape man's imaginative reconstruction of reality and therefore instruct man about his own identity" (Weizenbaum, 1976:159). The effect, according to Weizenbaum, is indeed profound. The computer is seen to "put muscles on analytic techniques that are more powerful than the ideas those techniques enable one to explore" (1976:159).

John Dewey's definition of experience supports Weizenbaum's idea. Dewey speaks of the undergoing as well as the doing in experience. This undergoing is part of a dialectical relationship the person has with experience and allows for the reciprocal functioning of tools so that the user adapts and alters to accommodate and understand the new experience.

The machine invites this separation of technics (personally held skills) from that which is pure technique (*mekhane*), so that one *chooses* to be primarily concerned with the machine's orientation. Anything else is counter to the machine directive of expediency.

> ...the history of industry amply shows that the central fact of the machine remains the possibility it opens up of an independence and separability from, and indeed indifference

> to, human movements, interests, and purposes on the level of the making action itself, and that this independence and indifference is correlative to the recognition of the objective potential of the machine as such (Bruzina, 1982:171).

The computer embodies experience. It subsumes experience in a temporal sense, altering its significance by rendering it a factor to be dealt with. The act of doing is speeded up, ignoring the value of the process under the assumption that getting it done is of higher importance than knowing how to do it.

The manner in which experience is eroded can be understood by considering the computer's manner in altering it. There is a growing vacuum of sensory experiences presently available to the school student. More and more the environments of these institutions have developed into atmospherically controlled complexes which filter out naturally occurring elements, providing an atmosphere that is as consistently comfortable as possible. Textbooks, video machines, movies, etc. have enhanced the student's perception of the world. Yet these media do little to touch the child directly in a physical manner. Without sensory experience to draw upon, students would fail to appreciate the circumstance that is being alluded to. Simply stated, students must have experience to learn how to read words.

People may be becoming less involved in their environments overall, both physical and social. Craig Brad, a psychotherapist in Berkeley, California, has been working with patients he has classified as suffering from technologically induced stress.

> For thousands of years we have learned by observing the details of the culture we live in. Now, suddenly, we find ourselves doing much of our work and play essentially by remote control. Where once a boy and his father may have worked side by side to build a table, learning about the properties of wood, hammer and nails, now they sit in front of a screen handling abstract data (Brad,1984:9).

To Brad, the computer is taking the place of personal experience. By spending time with it, there is less time available for other, more human, pursuits. "As we learn more and more directly from the computer and less and less from our own experiences, we may be

losing the important tactile dimension that is so crucial to the development of true intelligence" (p.9).

What makes this phenomenon more difficult to counter is its insidious nature. More association with the computer establishes more types of work to be accomplished. This increased work load in turn demands a greater number of hours to acquire the new skills to handle this task, and of course the ever-changing software and hardware packages ensure that no sense of mastery can be achieved. "Yet students, parents, and even teachers believe that because they handle more information faster, they are getting smarter" (p.10).

Brad believes the constant association with, and reliance upon, computers forces us into a situation where "humans are expected to perform in accordance with machines" (p.12). The demands are for computer-type qualities to be reflected in our business and interpersonal relationships. "Unwittingly, we are adopting as our own the computer's standards. We have come to expect from people the perfection, accuracy, and speed to which computers have made us accustomed" (p.15).

These pressures may be more ubiquitous than Brad's situation implies. Both the use of computers themselves, as well as the social environment that demands its presence, collectively encourage the school system to socialize students effectively to operate in this setting. Maxine Greene (1978) has noted the obvious consequence of a distorted education. "Children who are prepared to learn and respond to objects instrumentally may ultimately come to be instrumentally responsive people" (p.195).

Peter Abbs suggests the emergence of such individuals:

> outwardly knowledgeable, inwardly blind; preoccupied with techniques and not with teleologies; responsive to the dictates of scientific progress, but not to the imperatives of human culture, should serve to unsettle us all (Abbs, 1979:56).

The sentiments are shared by Marilyn Ferguson who writes in The Aquarian Conspiracy that the school system presents dangers to both the mind, and the spirit. Ferguson states that

> the greatest single social influence during the formative years, schools have been the instruments of our greatest denial, unconsciousness, conformity, and broken connections. Just as allopathic medicine treats symptoms without concern for the whole system, schools break knowledge and experience into "subjects", relentlessly turning wholes into parts, flowers into petals, history into events, without ever restoring continuity (Ferguson, 1980:282).

Schools reflect the values of the greater culture that nourishes them. If students can be taught to acquire certain skills to reinforce these values, there will doubtless be an effort made to teach these skills. And if in order to accomplish this learning, individually held values are placed in jeopardy, the loss of these values may be considered as part of the lesson offered by the greater society.

Where particular skills are deemed of importance, individuals who possess these skills are likely to be in demand. But what if these skills can be mimicked so that they may be seen to be possessed by virtue of certain productive outputs? Technological society presents this opportunity. At an extreme that Steven Goldman (1984) believes exists, technology may be understood as referring today to:

> a particular social process, to a form of action that is decision-ruled, one in which specific "captive" knowledge bases in engineering and science (primarily) and craft skills (secondarily) are put at the disposal of people who in general are not themselves competent in those knowledge bases and who wield them on behalf of ends reflecting a parochial interpretation of prevailing personal, institutional, and social values (p.121).

Such a condition relies on the utilization of embodied techniques and their application precipitates mediocrity. It is not therefore truly reflecting human potential, but particular systematized capability.

Questions of Pedagogy in Art Education

Usually, with computers, tasks are accomplished in the most expedient manner. Such is generally the intent behind the computer's use. The ability to make expediency

paramount for the user is indicative of the nature of technology to seem to dictate emphasis. An apparent trade-off between initial user value and machine priority is signaled, to take over the relationship. The trade-off is experience. In other words, the value of the act of working on the art work may be viewed as secondary to the amount of information now contained in a single drawing or painting.

A general tendency exists to deny that any trade-off has taken place, to believe instead that the user is the controlling factor in the use of technology. Donald Phillip Verene (1984) notes that "despite the analyses," we tend to hold to our belief "that man is free; that man uses technology and that if techniques do not always appear to follow man's will they could be made to do so" (p.101). What is at stake is the question of personal freedom within a technological environment.

Machine priorities are not human priorities. Technical progression takes place as a result of instrumental needs of the user and are largely directed towards the enhancement of further technologies. As John Michael Krois puts it:

> ...technical innovation is directed to strictly practical ends, and, unlike artistic creation, does not strive to express human feelings. Works of art gain their significance from the way they express an awareness of human experience, but a technician's understanding of life and his own personality are incidental to the development of technology (Krois, 1982:211).

Phillip Fandozzi, (1982) in an article called *Art in a Technological Setting*, declares that just as technology is at the service of art, so too is art at the service of technology (p.4). When this happens, states Fandozzi, it occurs at a great price.

> It loses its integrity and becomes merely a source of profit, entertainment and diversion... Technology results in the isolation of function from all context and thus in the securing of its products as "ready for use," with the use itself often presupposed, being largely dependent upon traditional values and a vague sense of the plasticity of human desires. The function is seen as the essential gift of technological progress while the use and productive process recede into the background (Fandozzi, 1982:4).

Fandozzi believes that technological imperatives have superseded human "mediation" between the person and the physical world. Dismissing the need for mediation and the possibility of genuine response "only reinforces those technological attitudes which will eventually destroy art and the integrity of human responsiveness" (Fandozzi, 1982:11).

The effect of this disturbance is widespread, according to Fandozzi, and requires us to understand contemporary art only by recognizing its influence. Fandozzi states that most theories

> of modern art have tried to find the appropriate plastic form which would complement the best features of technology and humanize its cultural influence. In this project, they failed to recognize the way in which technology undermines such attempts and reduces them to arbitrariness (p.10).

Using computers for art is already an acceptance of the role of technology, although it does not necessarily recognize the extent to which this technology tends to control the experience. But if we accept that technique is embodied within technology, it would then seem necessary to ask of what significance it is for that which was a human quality to be now contained within a machine environment. Is the need for human adeptness lessened to the point that they may no longer wish to retain this knowledge? Or could a lack of reliance on such human skills actually prevent such retention? In other words, if specific skills are easily duplicated or even enhanced by machines, does this make human skill knowledge redundant? And what of those operations whereby human capability is clearly inferior?

The extent to which there is a reliance placed upon the technology to help define direction will affect the results of that work. As designers, architects, and engineers utilize technology more there is an increased possibility that they will lose "the individuality and eccentricity that inspires breakthroughs. They will also move further and further away from the human dimension that makes their work aesthetic" (Brad,1984:9).

CHAPTER THREE

Elementary School Students

Introduction

This chapter contains a description of the art pieces which were made by the elementary students using the Macintosh computer. The definition of elementary student was chosen as it most clearly differentiates between the older and younger child. It was not intended as a restriction to the sample as there is no purpose to be served in limiting the respondents to a specific age or grade range. Therefore this section includes children from Grade One to Grade Seven with all but one student in the elementary range. Students were generally enthused by the computer's appeal and were always eager to get time to do some experimentation.

I have had a little difficulty in finding terminology to describe some of the pictures which are included in this chapter. I was not quite certain as to whether or not to call the particular computer function that was used a pencil or the pencil icon by this name. For the sake of clarity I have maintained the program icon of brush, pencil, spray can, etc., according to what the children came to know them by. The reader is referred to Appendix A if in doubt as to the function that has been utilized.

The term *free-hand* , which has often been used in reference to that type of drawing which is not done with an instrument, is used here to separate the child's drawing with the mouse from the invoking of a procedure to handle the problem, e.g. draw a circle. The other method of drawing this would be to physically trace the outline with either the pencil or the paint brush icon.

The Students

Greg and Jon

The two grade one boys, Greg and Jon, are of completely different natures and abilities. Greg is very self-assured, suggesting through his attitude that he already possesses sufficient knowledge to control the computer. He repeatedly orders Jon on or off the computer and attempts to direct the Principal and myself to other tasks as he sees fit. Greg is usually first on the computer and, by some expert maneuvering, usually also the last, leaving Jon to a shortened middle time. Jon is physically smaller than Greg, less knowledgeable of the Mac (Macintosh), and somewhat in awe of Greg's computer expertise. Greg and Jon were usually humorous in their activities, proving to be somewhat unpredictable in their approach.

Greg's picture, "Auger and Truck" (E1), was made without the use of any of the computer program's tools other than one paint brush and one application of the fill routine for the black ground. The picture is active with grain moving up the auger and tumbling down into the open truck. It gives as much detail as necessary to tell of the event but does not go further to include the use of shading, patterns, excessive use of fill or purely decorative lines.

"The Big House" (E2) on the other hand is made with several of the tool options being brought into play, which results in a house that is somewhat prefab in construction. The windows, door, and the house itself are made with a geometric tool and then filled in. The only part which escapes this use is the figure at the bottom of the picture who is also inactive (but happy).

"The Planet of Silver" (E4) is another example of Greg's preference for the use of a relative naturally-gestured line over the circle tool which he is familiar with. There is a spacecraft entering from the right side of the picture, approaching the planet of silver on the left, each part left to show the white paper behind, very much in contrast to what the older children will do with the fill routine.

An example of the degree to which Greg will go to gain the upper hand on the computer was shown by his attempts to draw a straight line on the screen. On one particular day he took the entire 20 minutes to try to draw a straight line and then magnify it so that he could make corrections. He was shown by the Principal how to do this instantly with a line tool but still preferred to take the time consuming route of making a line and then correcting it on his own.

Greg decided to use a black background for his "Spider" picture (E6). This picture shows an imaginative use of the black background with a white square paintbrush allowing him to make a negative picture of the spider. In the next picture he attempts to use more of the built-in features but fails to have the effect really interest him. "This Maze is Flooded" (E7) shows the use of options for the sake of experimentation and not for the depiction of any particular idea.

Greg does not really get involved in this picture. It offered an interesting diversion but it was one in which he found little motivation. The maze was constructed of only two main lines which were drawn in the upper left corner. This maze was reflected in the other three with the mirror options. Afterwards small lines were added to seal off each section and a fill was then used. By the time Greg reached this stage he was busy devising a game to justify the activity. This attempt to use the built-in functions of the program in a meaningful manner can also be seen in the border around the castle picture (E3), where he has used two different fill patterns to enhance his picture.

"Red Rose" (E8) was done for his mother. Greg probably lacked a working knowledge of the rose but has still produced a picture that has undoubtedly been well appreciated by the recipient. A paint brush was used for the picture and Greg has left the background white, again resisting the over-use of the fill routine.

Greg has largely rejected, or not yet seriously considered, the use of ready-made shapes and functions, relying instead upon his own control of lines. Fill-in's are used

freely but conservatively, and he is often content to leave large areas of white in his pictures.

Typically, Jon and Greg spend a class on the computer with Greg usually taking possession first. Jon lacked the confidence in his abilities on the computer that were so apparent in Greg. On one occasion, after a great deal of impatient pleading, Greg finally relinquished his turn to Jon. Jon sat there looking at the blank screen for about 30 seconds and then turned to Greg to ask him, "Will you draw the picture for me?"

Jon's farm picture took several days to complete, with it being saved and added to slowly. Two copies are included to illustrate the accomplishment of a particular work session. In the top picture Jon has drawn a tractor, silo, and storage bins. Each is made with the pencil and then filled in black except for the silo. The brick pattern offered an interesting means of filling in the image so that it appeared as a building.

The lower picture is an exact duplicate of the top with one building added, this time with a vertical fill pattern. Jon could continue this way for quite a while, this session taking him over 20 minutes.

Jon was asked by the Principal to make a picture showing life on a farm. His intentions differed somewhat, preferring instead to make use of some of the features of the drawing program such as the fill-in rectangles and circles. After a little bit of loose experimentation he muttered "I know" and proceeded to make pages of filled shapes using a grid pattern.

"These are waffles," he told me. When the Principal returned and asked him if he had made a farm picture. Jon showed him the waffles (E11 & E12). "See. This is what farmers eat in the morning."

In the collaborated picture with Greg (Space E14), Jon took a back seat, making suggestions and adding the stars.

Paul

Paul was present for only a single class. At this time he made the picture in Figure E13 using a paint brush. It is drawn free-hand without the use of computer options until the fill patterns were chosen. The patterns flatten out the drawing and are unrelated to the forms.

The figure utilizes a number of patterns which were interesting to Paul at the time. These were not planned in any sense but selected from a list of possibilities at the last moment to add something to the empty spaces created in the drawing.

Matthew and Jared

Matthew and Jared are in Grade 3. These boys are close friends, in the same classroom, and get along well at school.

"Designworld" in Figure E15 was made by selecting a fill pattern and then a shape tool. There is a random use of patterns and shapes with the picture being basically an experiment in what the tools could accomplish.

The tulip in Figure E16 was made with a paintbrush and black fill. The small brush option was used to outline and then the drawing was filled in. The resulting flat black silhouette did not seem complete so Matthew added a background fill.

The circle tool and pencil were used to make Garfield (E17). These provided easy means of building a basic shape of Garfield that Matthew perceived was closer to what he wanted then he could otherwise accomplish.

The flower pictures, E18 & E19, are predominantly flat silhouettes with broken areas of light fill. In one example (fig.E18) the picture was bounded by borders with a proportion that resembled the Canadian flag.

Scale E20 and Grandmother's House E21 pictures were drawn entirely with ready-made components, sort of pieced together.

Differences in what occurs when the computer is used versus paper and pencil is illustrated in Matthew's horse and wagon picture E22. At first glance they are surprisingly similar in content. In fact if both pictures were described to someone who had not seen the pictures, they would have to sound almost identical.

When looked at more closely there are a number of interesting differences. First of all, the rigidity of the computer drawing (horse's legs and wagon body as perfect rectangles). The tendency to use geometric perfection when available is evident in the body of the driver, the wagon covering and the wheels.

Freedom to go a little further in many steps is evidenced in the pencil drawing. Notice the eye of the horse is a circle in the drawing but just a dot in the other picture. This occurs again in the horse's reigns, in the moving legs of the pencil drawing, and in the wheels of the wagon. Lines that were unwanted in the computer image were usually obliterated.

The pencil version also has people riding in its interior, a suggestion that was partially erased but still easily observable. Matthew didn't say why he tried to erase these people but possibly was already considering the enclosed (non-x-ray) image that he developed in the computer image.

This image is darker and has more solidity. The pencil drawing is more childlike, is more fluid in line and shape, and contains more detail with evidence of change.

The Dinosaur Statue E23 is again a filled drawing made with a brush. Minimal use of line and fill is evident. This is a quick drawing by Matthew.

Matthew's "Jack and the Beanstalk" E24 was actually drawn earlier than most of the other drawings. He did not yet have sufficient knowledge of the MacPaint program to utilize many of the geometric tools, consequently there is a greater use of freely drawn lines. The picture is very childlike and imaginative with the Giant's castle floating in the sky. It rests on a very organic line while Jack's house sits on a rigid line on earth, the only built in feature that is utilized. Matthew finds a way to break the rigidity by adding an extra

bit to the end. Later Matthew will tend to use the built-ins more vigorously, attempting to achieve a more exacting image.

The "John Walter Site" (E25) was a team effort by Matthew and Jared. It was given as a definite assignment by their teacher. The task was to show their visit to the site which had taken place the previous day. Illustrative demands seemed to dictate a business like approach to the drawing, so they used all of the functions they could to keep it simple and readable.

Jared's toothbrush picture (E26) was an attempt to find something interesting to draw. Jared had this with him from the Dental Hygienist's visit and it became an obvious choice when they looked around the office for something new to draw from.

Jody and Trina

The two Grade 6 girls, Jody and Trina, seem to be extremely close friends. Often during the computer sessions, when one of them would stop talking in mid-sentence in order to perform some small drawing task, the other girl would automatically pick up the sentence, finishing it as if it were her own. Both girls drew with care and sensitivity to subject matter that was initially regarded as typical for their age and grade.

In the Sunny Day (Fig. E27) Jody and Trina have made a very full drawing using the pencil and fill patterns. The picture is largely made without the use of shape tools or excessive fill-in.

The Breakfast Table (E28) is very geometric in construction, with a free use of the duplication and flip procedures. Jody and Trina did not want to have all of the plates appear as if they were identical so the contents of each are individually drawn.

The "Clown" (E29) is another team effort between Jody and Trina. It was made with a good selection of textures and patterns for the clothing.

"Easter Egg" (E30) was made with the circle tool. Each band is the end of an oblong with the eraser used to remove the areas that extend beyond the egg shape. Various fill

patterns were used with some control still maintained by altering the fill pattern in some bands.

"King Tut" (E31) was the most difficult picture the girls were involved in making, taking several days to complete. It was made with pencil, brush, brush mirrors for symmetry, and with various patterns used for fill afterwards.

Lady's Face (E32) is a picture created almost completely with the shape and fill tools of the MacPaint program.

Jody made the Grandma and Grandpa (E33, E34) pictures on her own. They were largely made with functions such as rectangles, ovals, circles and patterns. Very little was added with the pencil.

Aaron and Kyle

Two other children are included in this study. They are Aaron and Kyle, my sons, and have been included because of their ease in access to the Macintosh computer, and because of my ease in access to their opinions. Aaron is a Grade Seven student while Kyle is in Grade Four. Neither boy is overly impressed with computers per se, often not utilizing them for weeks at a time. One of the uses they both enjoy on a recurring basis is the MacPaint program which gives them a means of achieving a type of drawing that is otherwise not easily attainable.

Aaron is presently interested in making pictures that are an extension of his Lego building scenes. There is a definite relationship between the shape of many of his figures and ships, and the form of the plastic Lego parts. The scenes which he draws are much more military in nature than the built scenes, as the latter tend to be constantly changing with the building of new parts. These actual constructions are of at least equal importance (if not more) to the fulfillment of any role playing.

When Aaron draws on paper he adds horizon lines, some sense of perspective and usually a background. His computer images are a little different, with a great reliance

placed upon the special abilities of the computer to create replicas of a few key objects. As can be seen in his fighting pictures there is sometimes a lack of a definite horizon which results from his use of the copy routine. All figures are of equal size and therefore defeat any sense of distance, hence no horizon. The visual effect effect is as if the viewer were looking downward on the figures so that the horizontal space between them was lessened. The figures have tended to be largely two-dimensional although this has altered somewhat with the introduction of shadows under the helicopters that are in flight.

Figure E41, called Rescue, is a picture of a rescue scene on the ocean. The scene is drawn with a limited use of tools, mainly the pencil and duplication option for the fish. It is very active with the focus clearly on the drawing concept instead of the program's features and it is one of Aaron's more complete pictures on the Macintosh.

The drawings change as he gains more experience with the program, and also with the evolution of his own ideas. The first picture (E35) is of a single figure that has been duplicated many times and also enlarged. This figure is not engaged in any type of activity but appears to be representative of a large force. Other drawings maintain this image but in more subtle ways, using duplication but also with variations in some pieces and with more primary figures in the drawings. There is also a greater degree of action taking place in these more recent drawings, an interest being expressed in the fulfillment of a scene and not just the reproduction of a specific form.

Aaron has found the use of the duplication feature of the computer to be very enjoyable but quickly adds that some of its restrictions make drawing sometimes too difficult. The restrictive use of patterns ("colors") makes him comment that, "It's nice to color on paper but the computer knows only one kind of black." The computer is not suitable for the portrayal of subtleties.

Kyle stated that he liked his drawings that were made using the computer. From conversations with him it is not difficult to see that this enjoyment is not solely linked to an appreciation of the finished product but also to a remembrance of the time in which he drew

it. A picture immediately reminds him of the occasion in which it was made and, in reference to the toboggan picture (E42), he tells of coming back from his tobogganing. The person in the picture has "his hands in the holes. See?" From the picture it is very difficult to see, but the suggestion is clear and he has no trouble verbally making up for the lack of evidence that the rider is hanging on for dear life as he plunges over the embankment. This picture is made using the drawing pencil, without fill patterns and without any built in features.

The Christmas picture (E43) uses the circle tool for the snowman, but freely drawn lines for most other features. When asked what he liked about this picture he stated "the stars in the sky," which have a completely free style about them.

Kyle's wrestling picture (E44) consists of many of the computer options of geometric shapes and duplicated figures. He thinks that it contains "Good desks and pieces of paper." He is more unhappy about the figures, calling them "too square." Kyle said that he "couldn't draw the way (he) wanted to" which was taken to mean that it was too difficult for him to make small lines that did not appear squared off. He did want, and stated that normally could achieve, "sort of roundish arms and legs." With this picture he would settle for the ease of duplication of figures in lieu of detail.

Kyle's "Beauty" in Figure E45 is drawn free-hand in magnify mode (fat bits). The water design was a pattern which he modified and then used as a fill-in. The face of the figure in the boat is similar to that of the fighter in the previous picture. This similarity is almost unavoidable since there are a very limited number of pixels available for use. To create a difference in the two, Kyle has changed the hair in the figure in the boat.

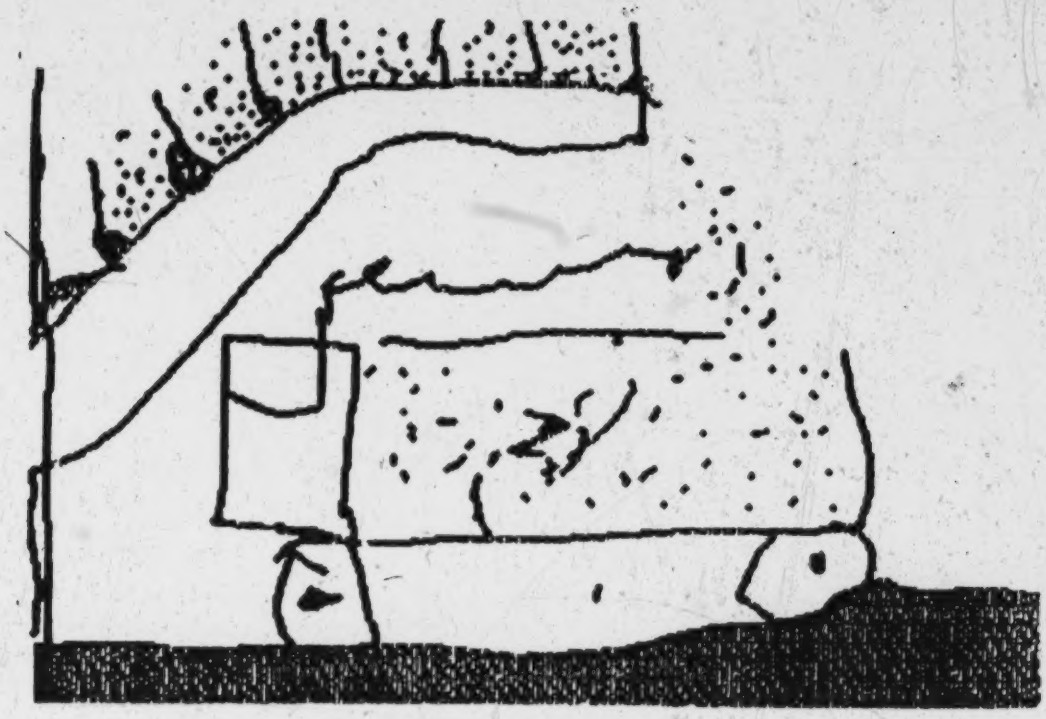


Fig. E1: "Auger and Truck" (Greg)

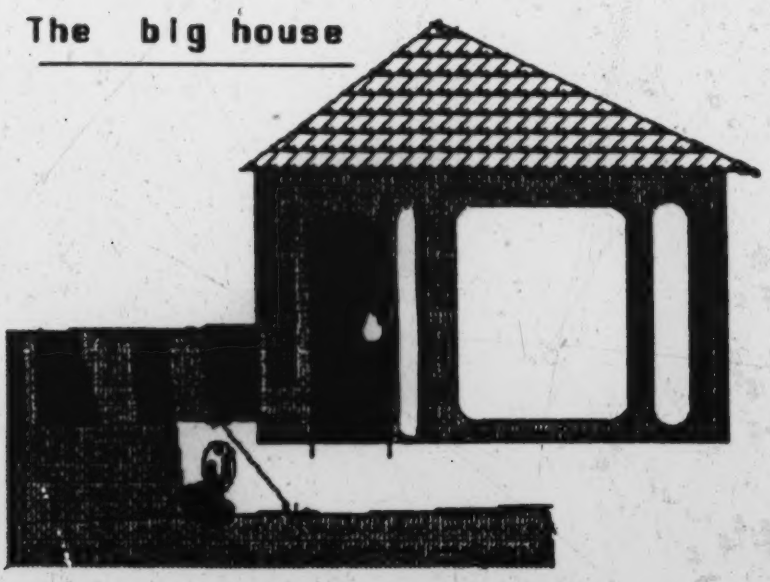


Fig. E2: "The Big House" (Greg)

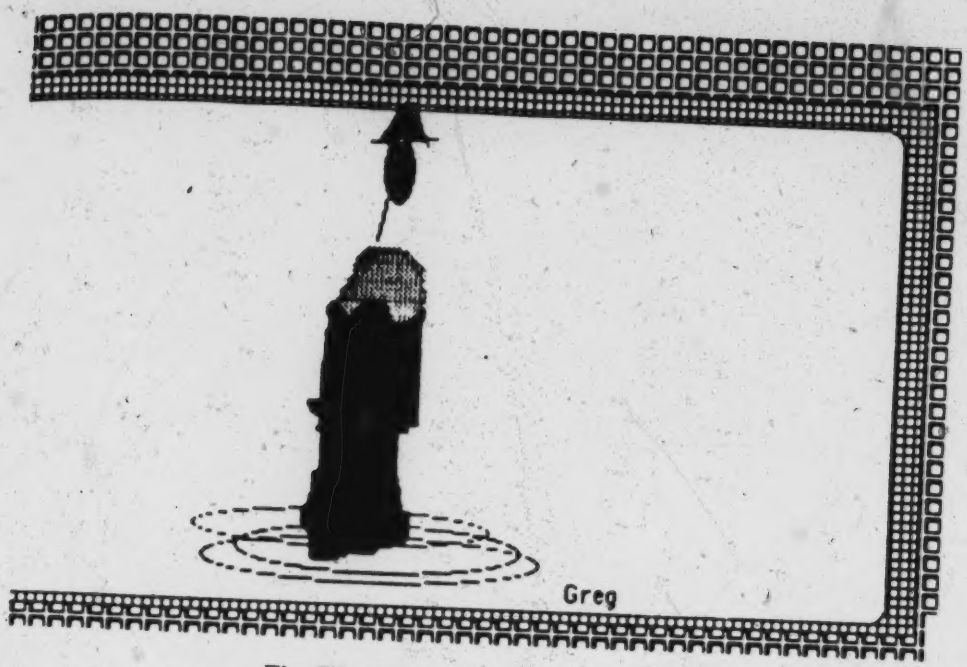


Fig. E3: Castle (Greg)

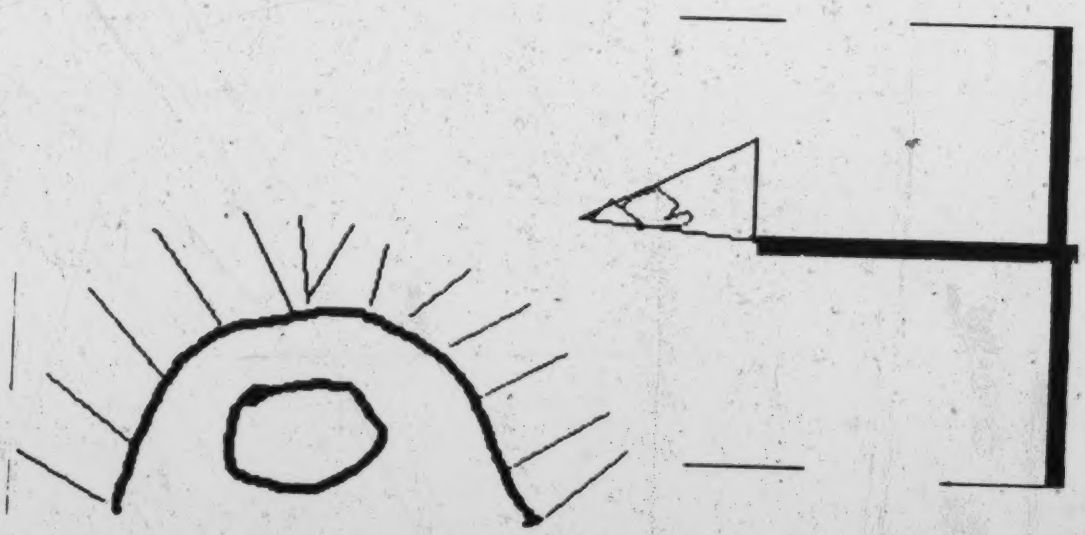


Fig. E4: "The Planet of Silver" (Greg)

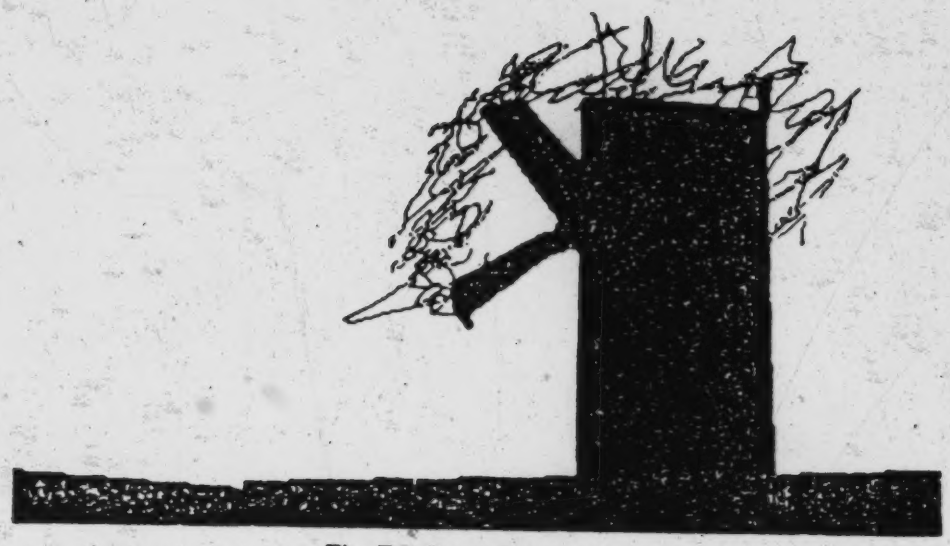


Fig. E5: Tree (Greg)

Fig. E6: "See the Funny Spider" (Greg)

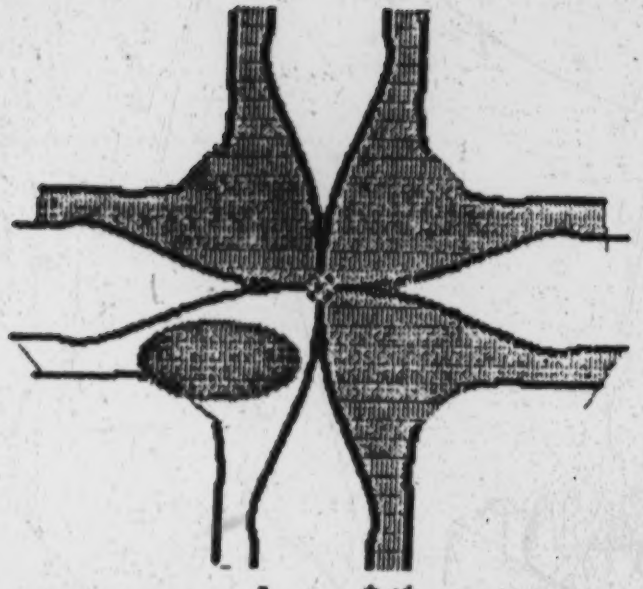


Fig. E7: "This Maze is Flooded" (Greg)

Fig. E8: "Red Rose" (Greg)

Fig. E9: Farm Tractor 1 (Jon)

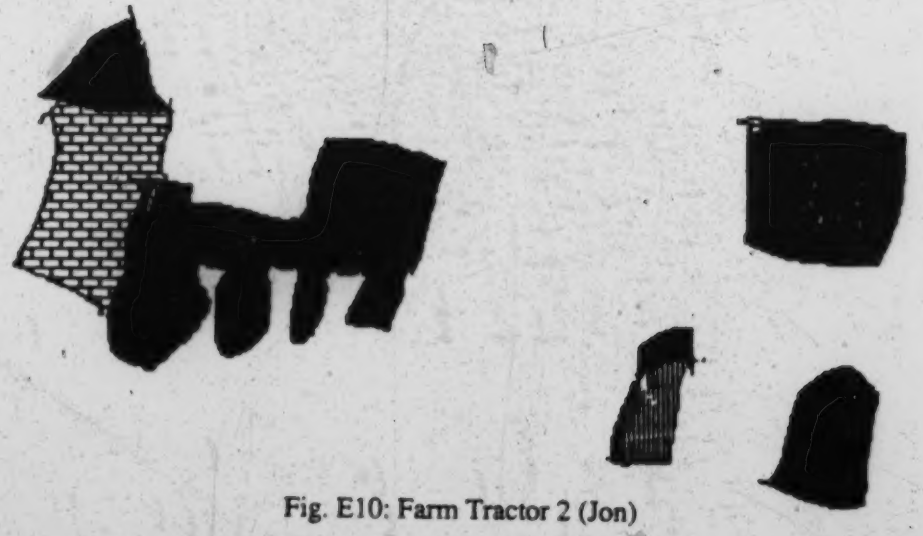


Fig. E10: Farm Tractor 2 (Jon)

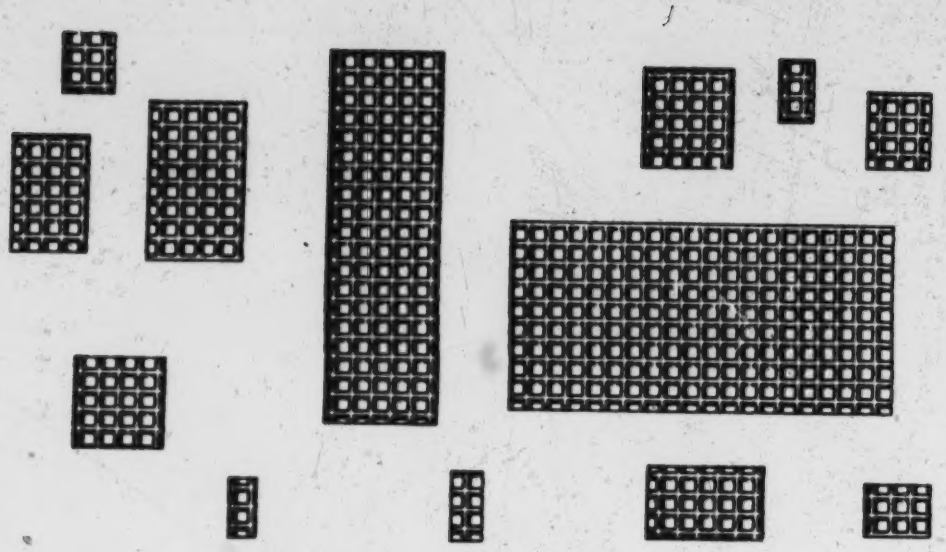


Fig. E11: Waffles 1 (Jon)

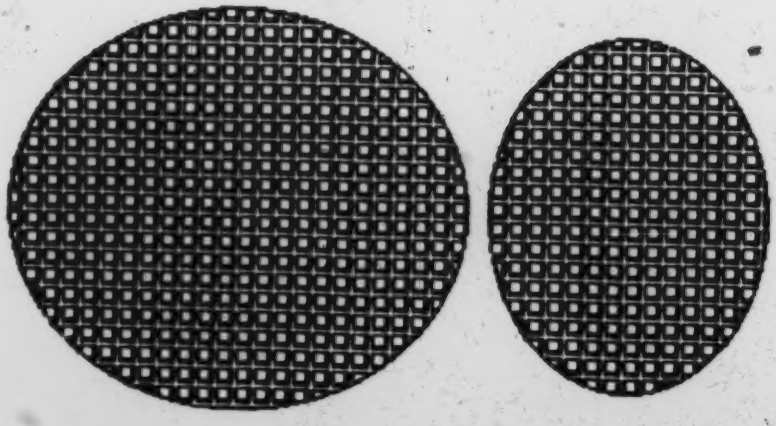


Fig. E12: Waffles 2(Jon)

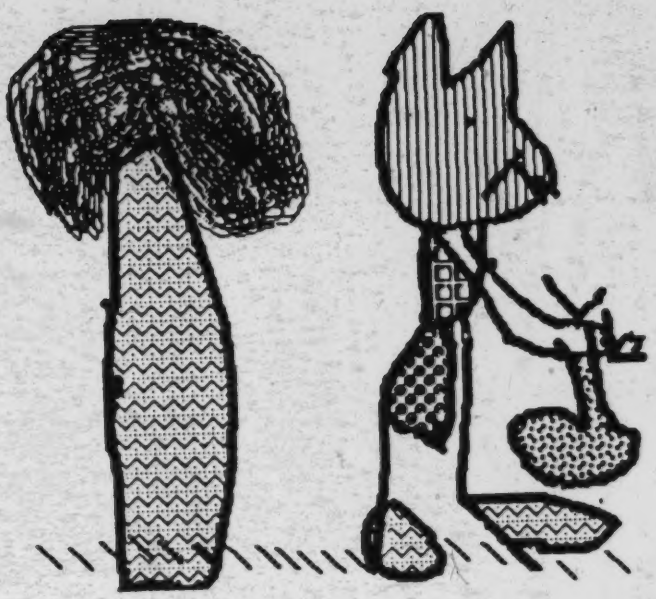


Fig. E13: Animal Figure (Paul)

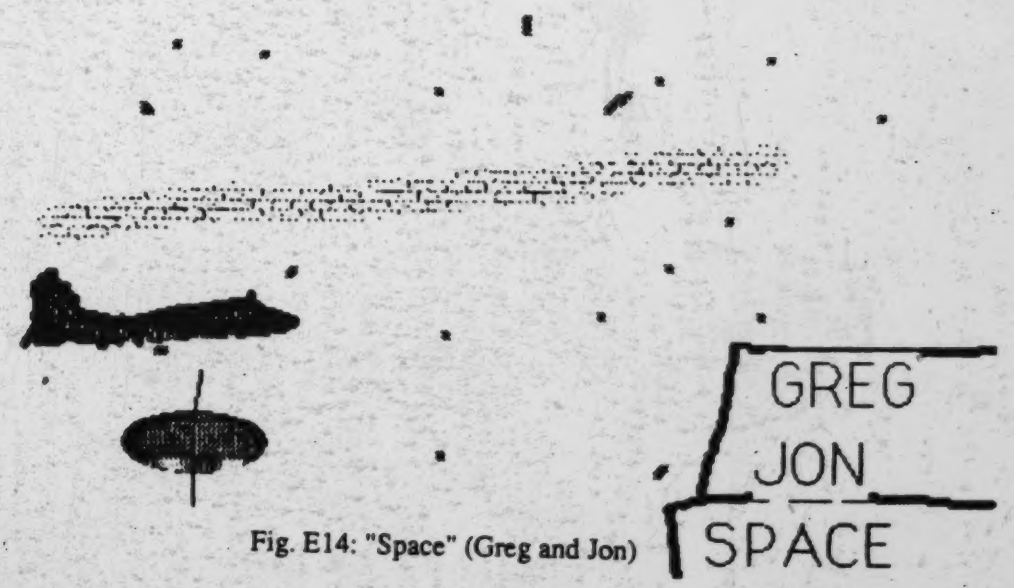


Fig. E14: "Space" (Greg and Jon)

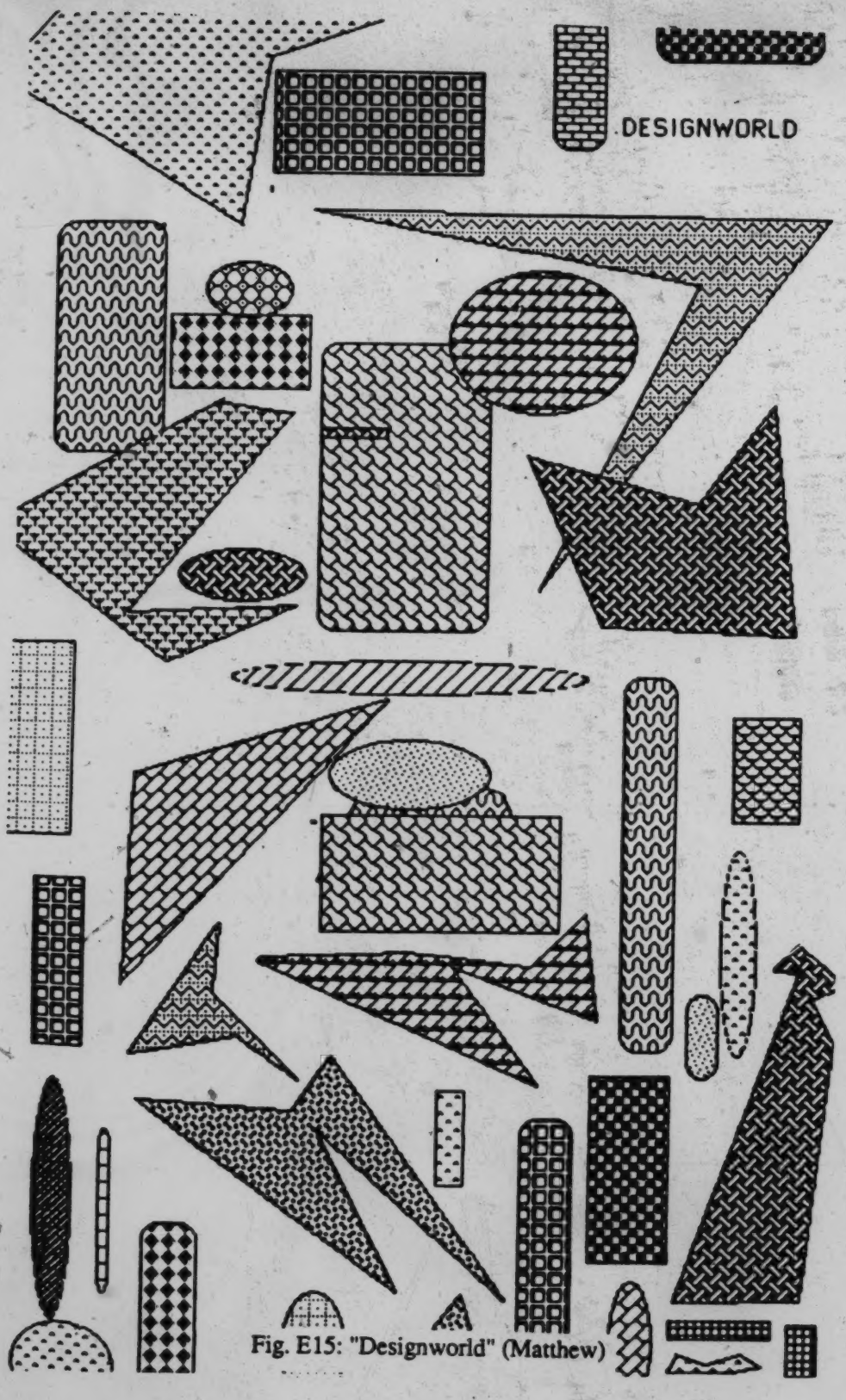


Fig. E15: "Designworld" (Matthew)

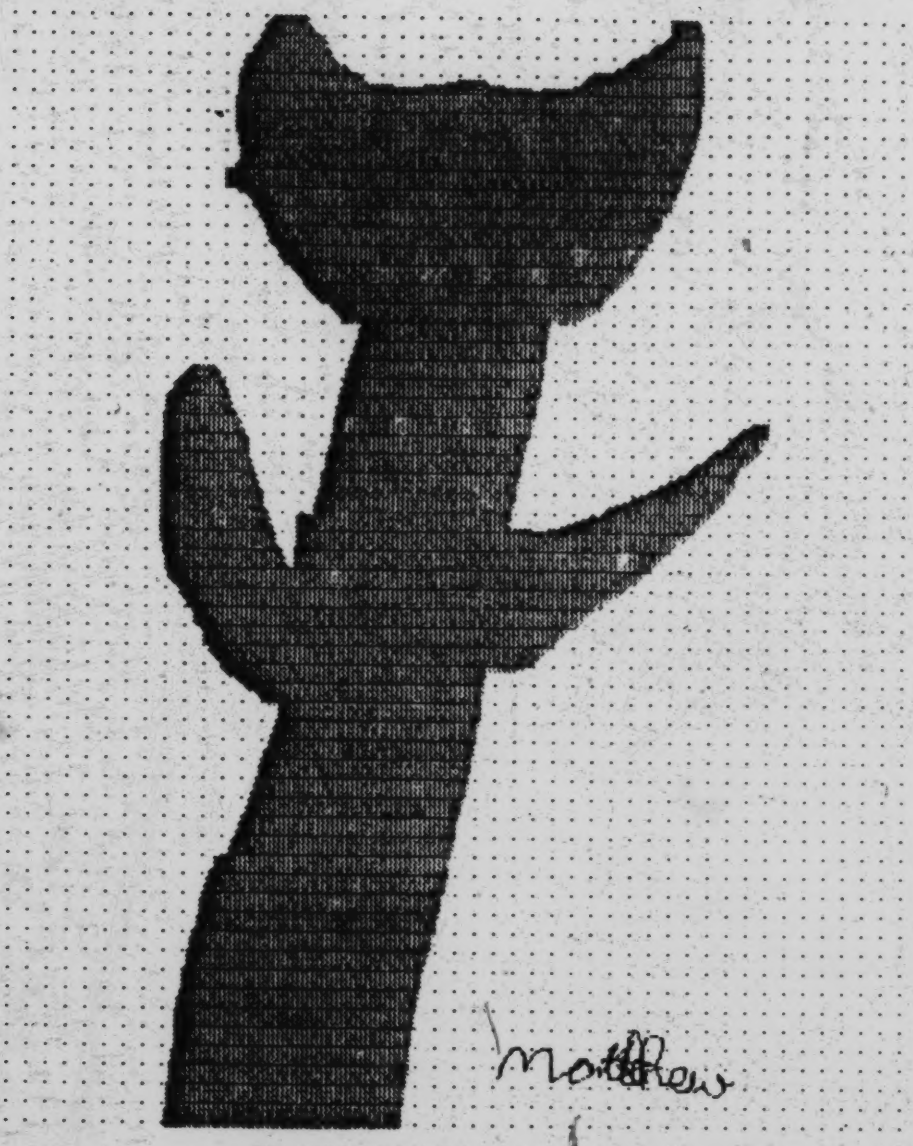


Fig. E16: Tulip (Matthew)

Fig. E17: Garfield (Matthew)

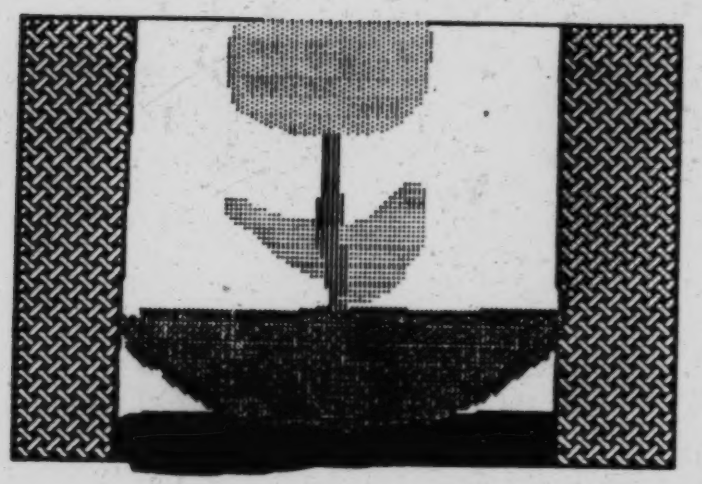


Fig. E18: "A Flower" (Matthew)

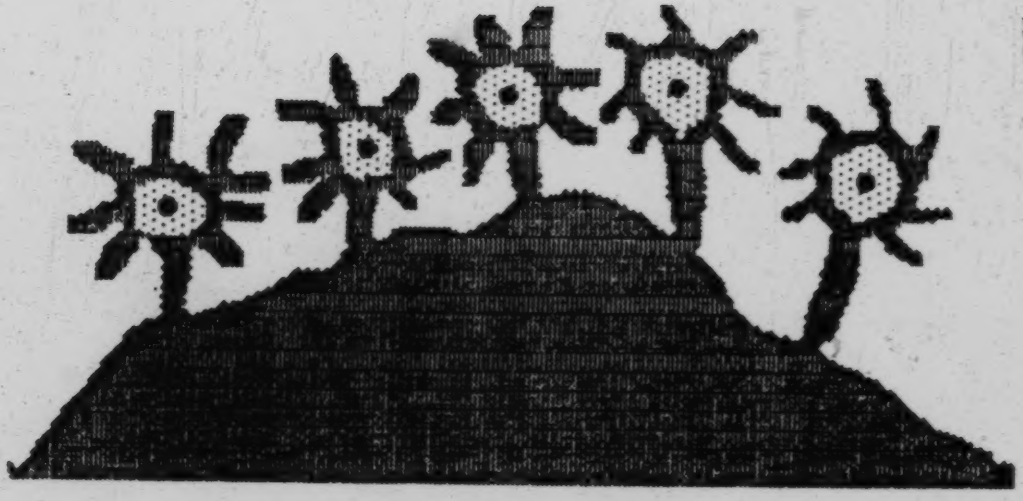


Fig. E19: Flowers (Matthew)

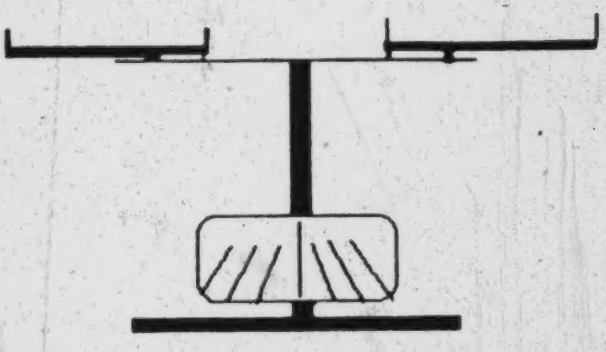


Fig. E20: "Scale" (Matthew)

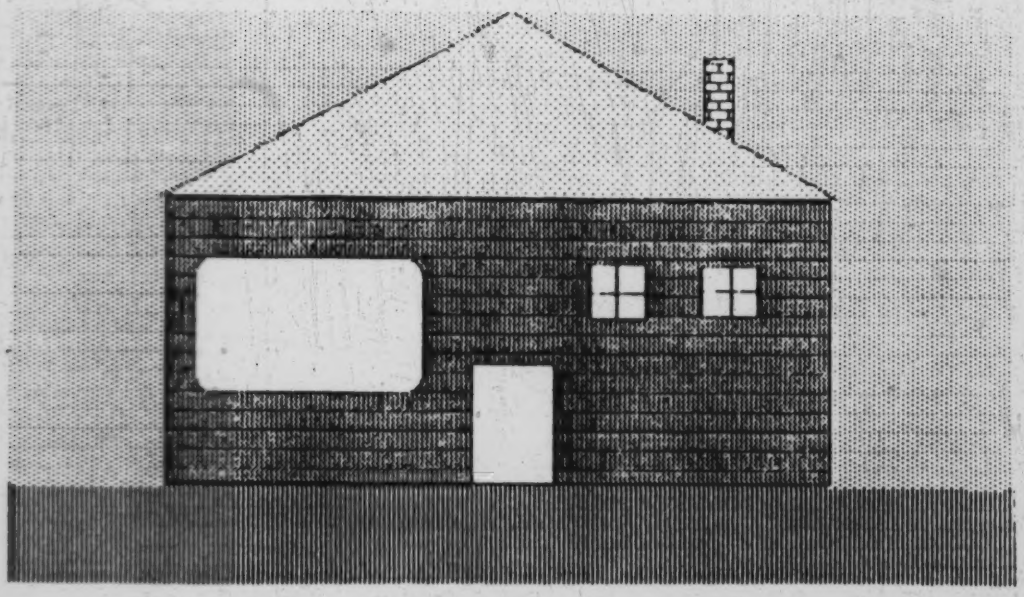


Fig. E21: "Grandmother's House" (Matthew)

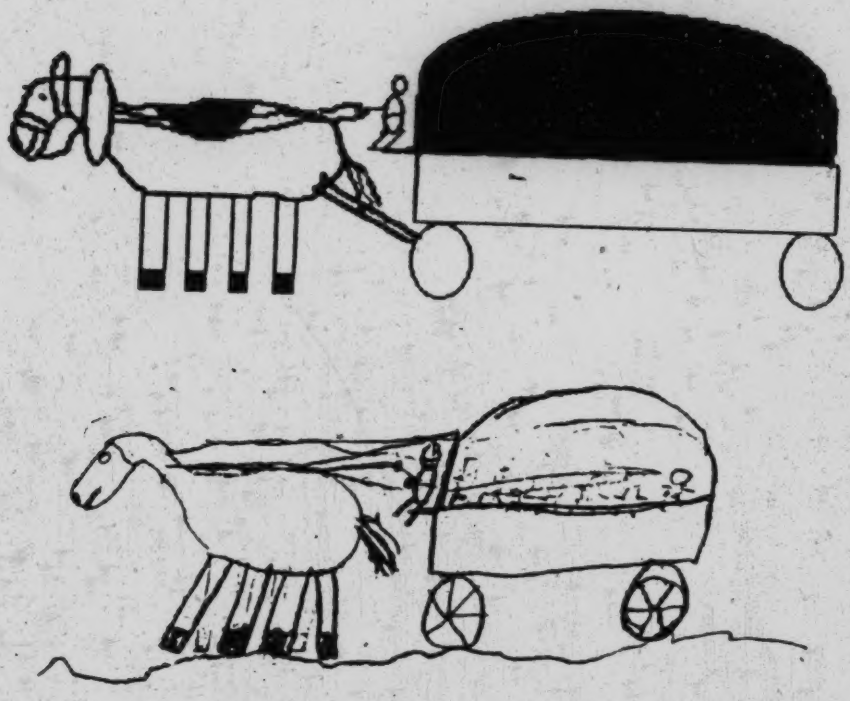


Fig. E22: Horse and Cart 1 & 2 (Matthew)

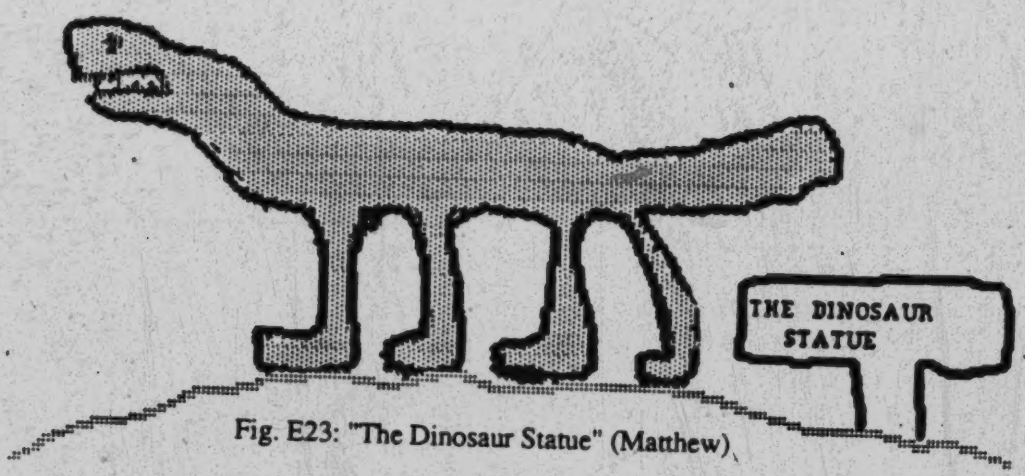


Fig. E23: "The Dinosaur Statue" (Matthew)

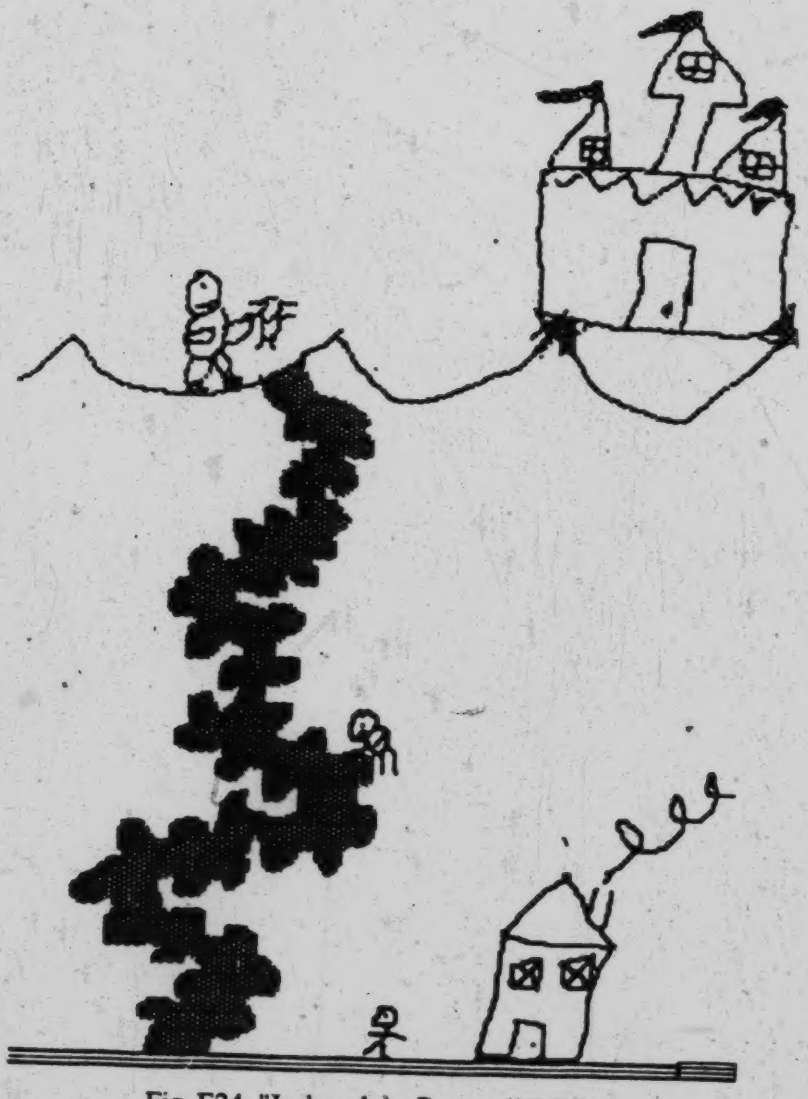
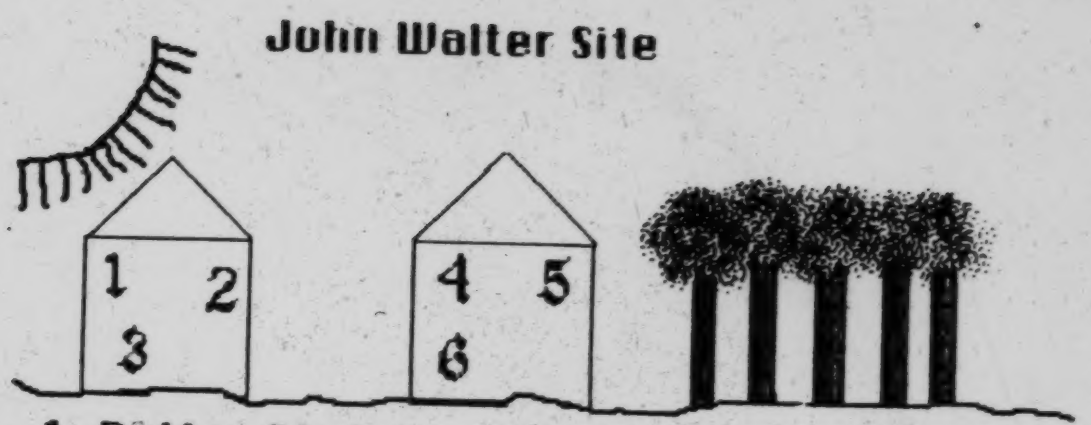


Fig. E24: "Jack and the Beanstalk" (Matthew)



1. Butter Station.
2. Scones Station.
3. Ice Cream Station.
4. Pillow-Stuffing Station.
5. Candle Making Station.
6. Household Chores.

Fig. E25: "John Walter Site" (Matthew and Jared)

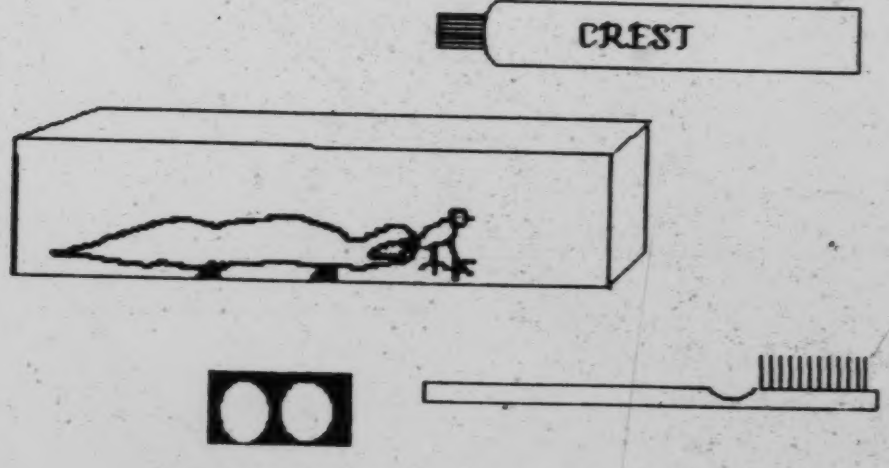


Fig. E26: Dental Package (Jared)

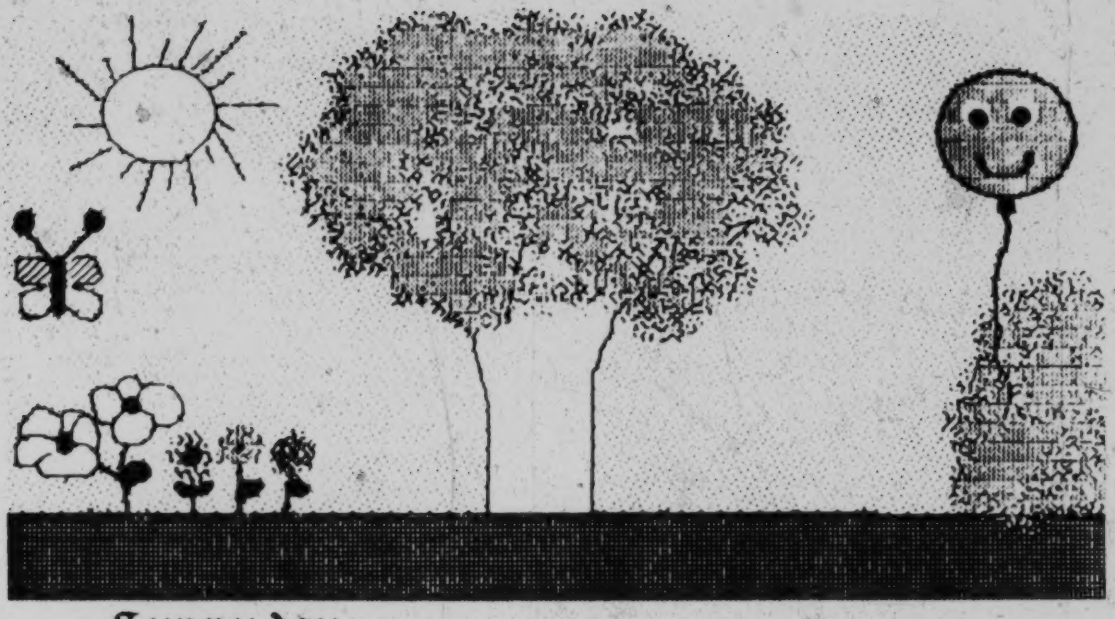


Fig. E27: "Sunny Day" (Trina and Jody)

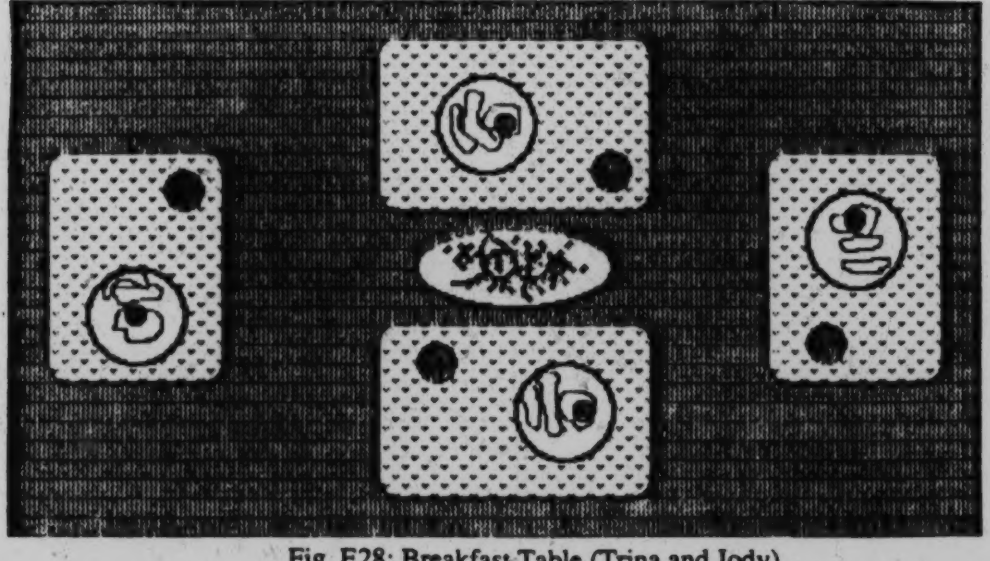


Fig. E28: Breakfast Table (Trina and Jody)

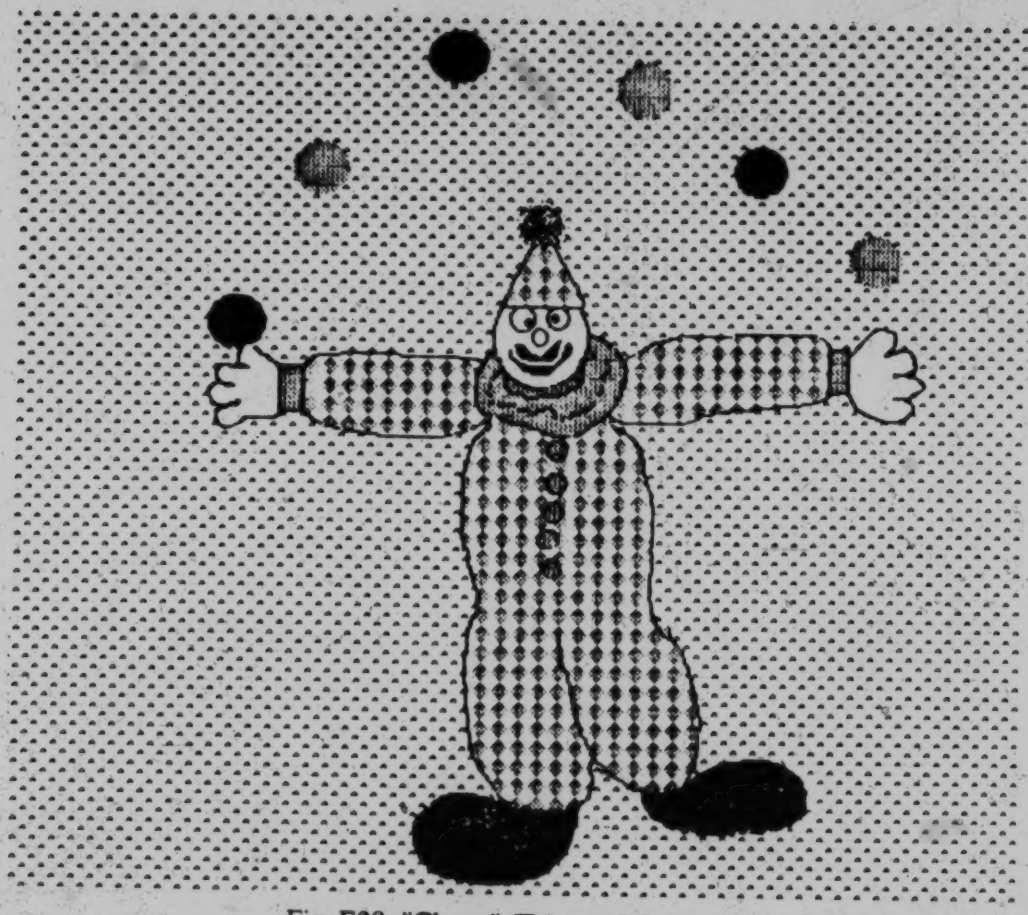


Fig. E29: "Clown" (Trina and Jody)

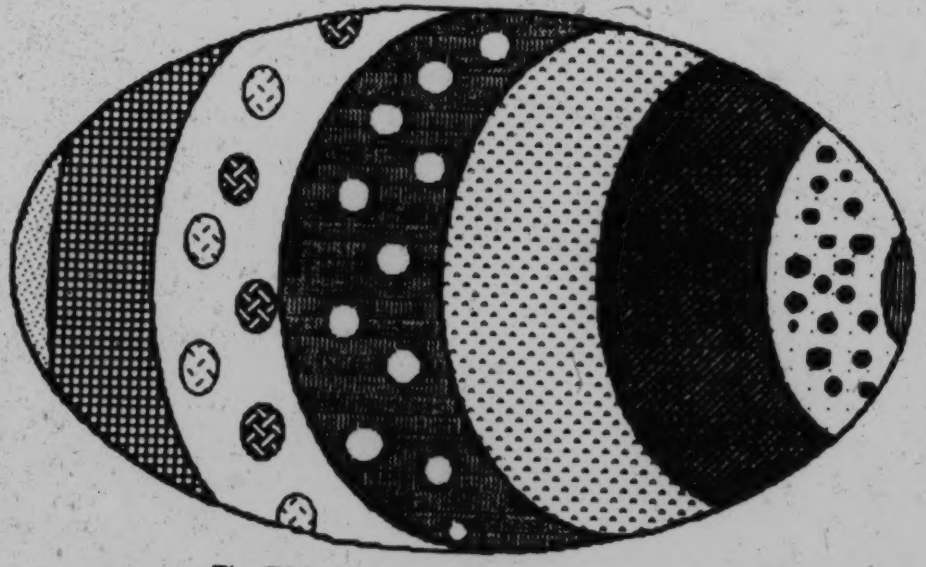


Fig. E30: Easter Egg (Trina and Jody)

Fig. E31: "King Tut" (Trina and Jody)

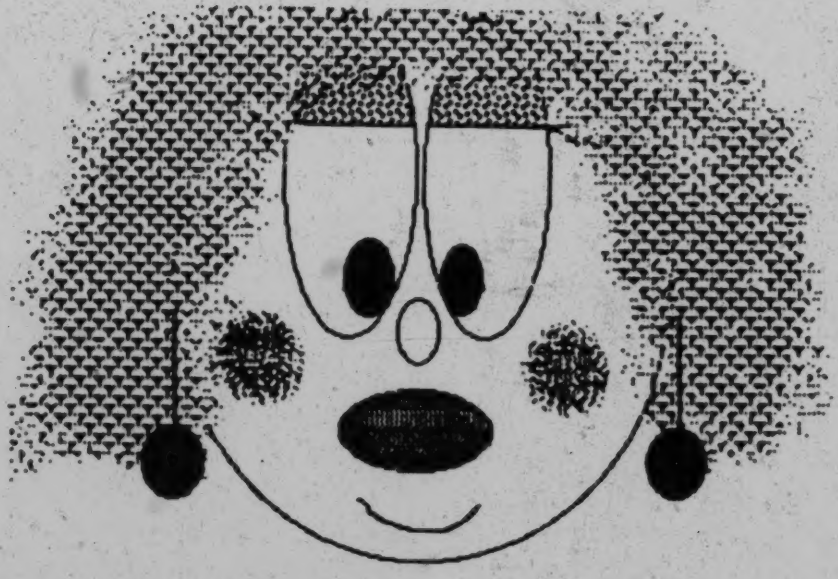


Fig. E32: Lady's Face (Trina)

Fig. E33: "Grandma" (Jody)

Fig. E34: "Grandpa" (Jody)

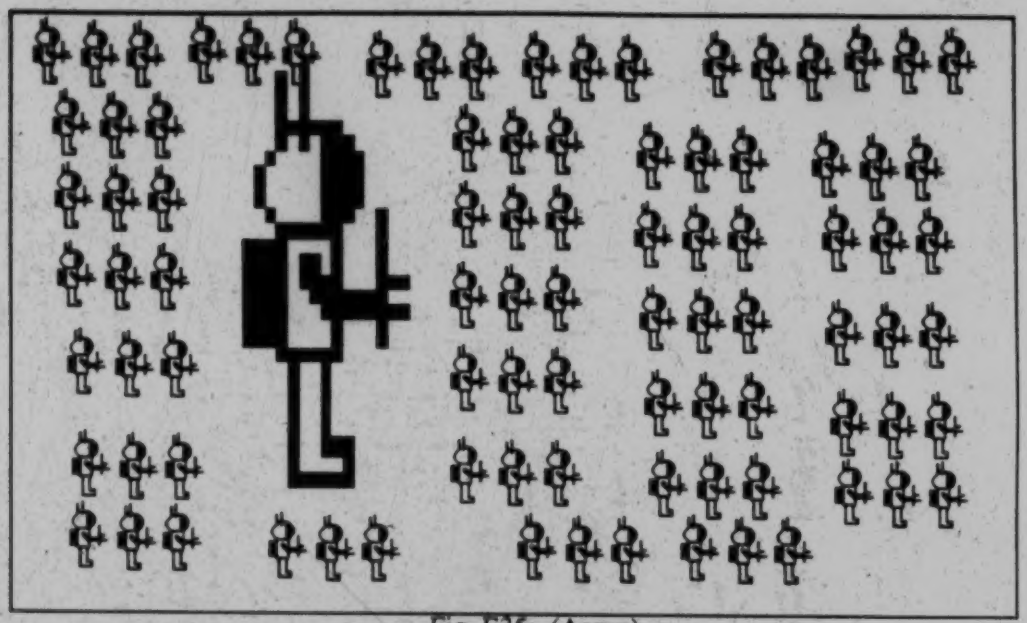


Fig. E35: (Aaron)

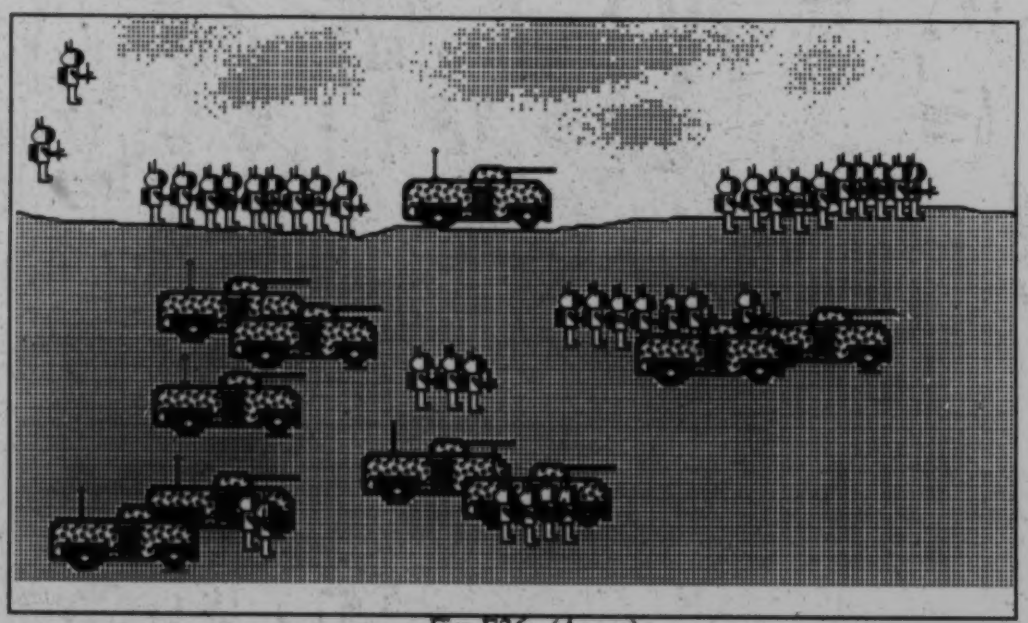


Fig. E36: (Aaron)

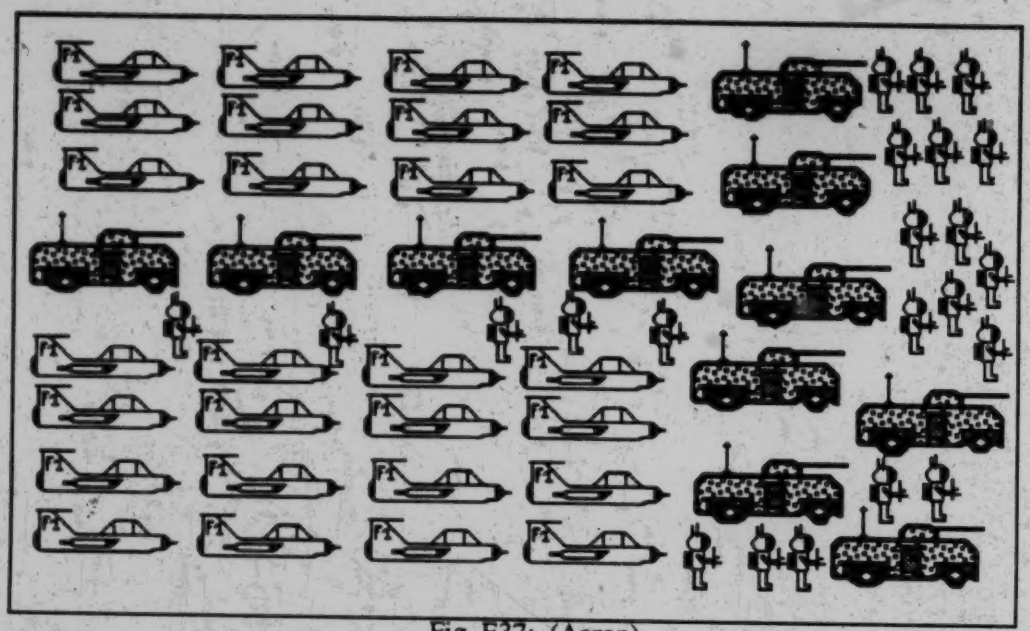


Fig. E37: (Aaron)

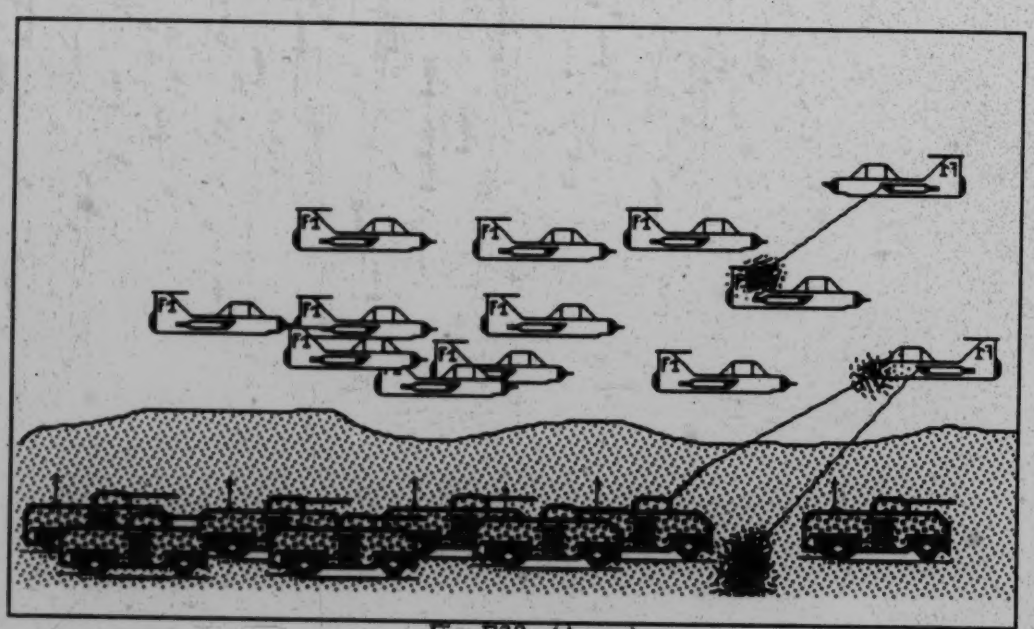


Fig. E38: (Aaron)

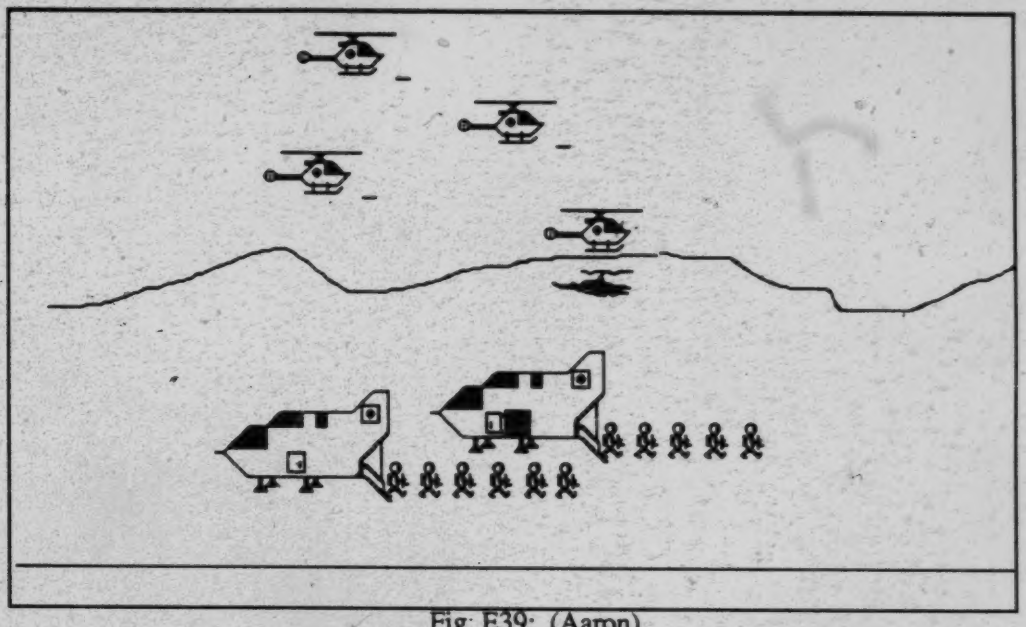


Fig. E39: (Aaron)

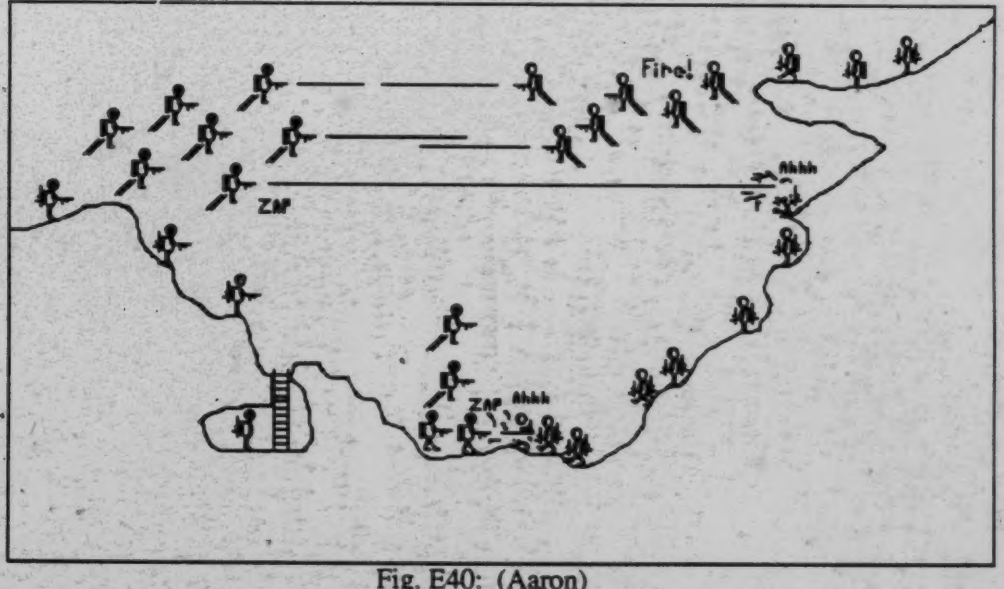


Fig. E40: (Aaron)

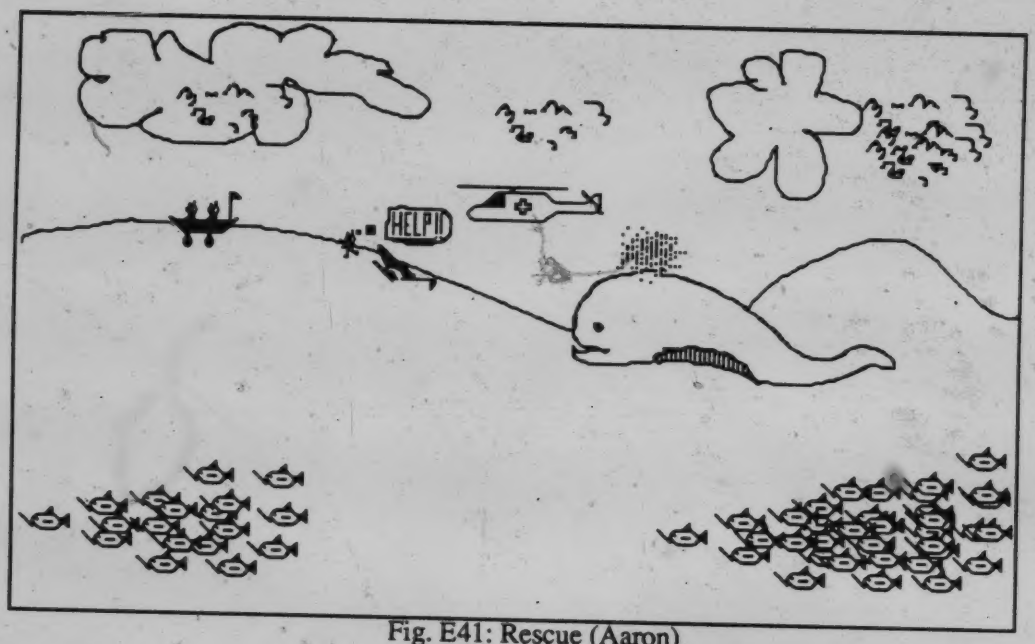


Fig. E41: Rescue (Aaron)

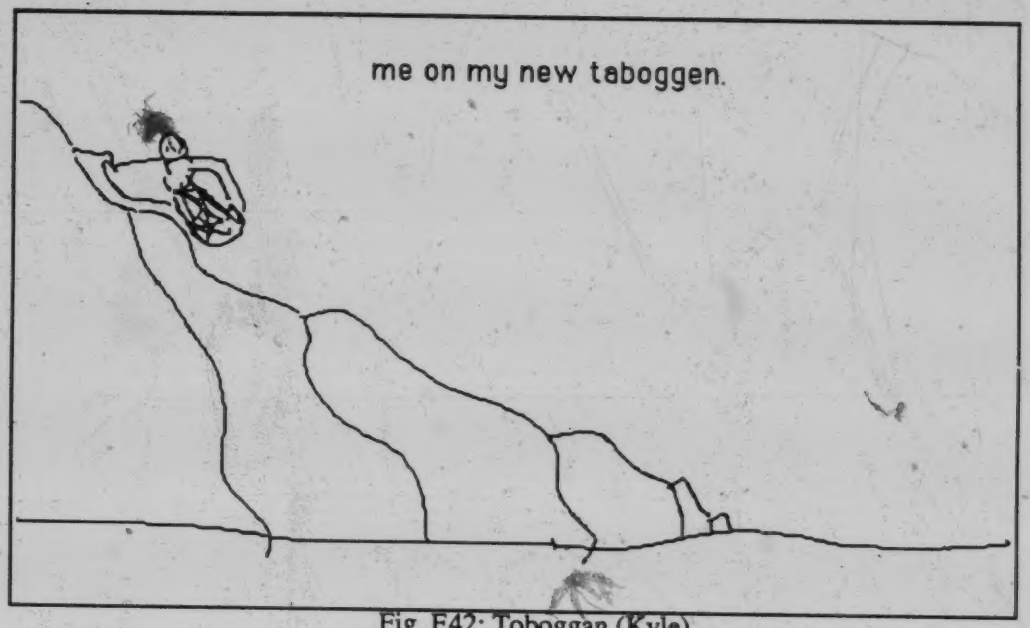


Fig. E42: Toboggan (Kyle)

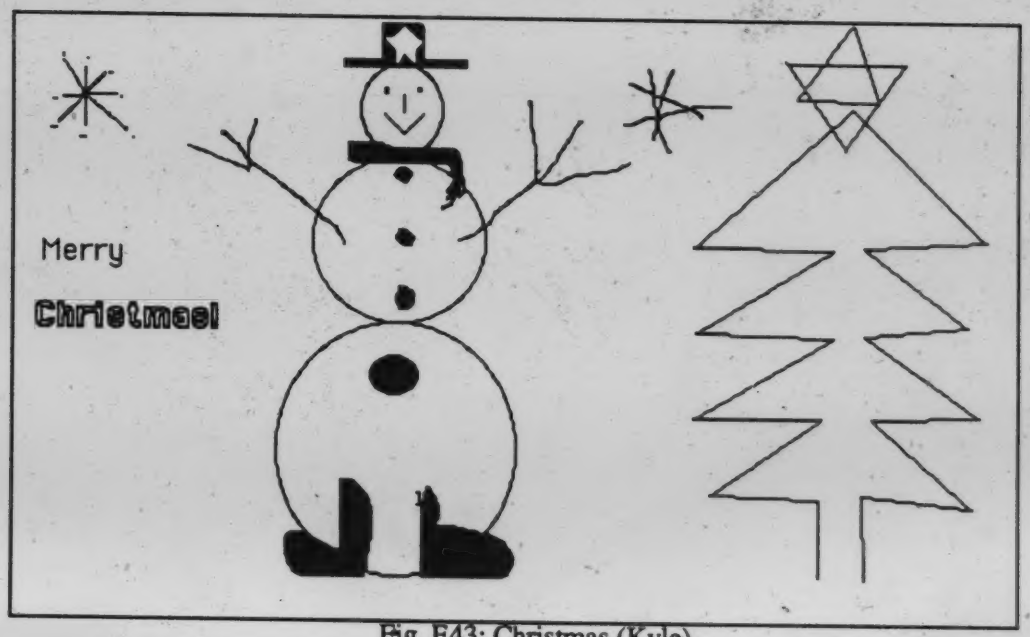


Fig. E43: Christmas (Kyle)

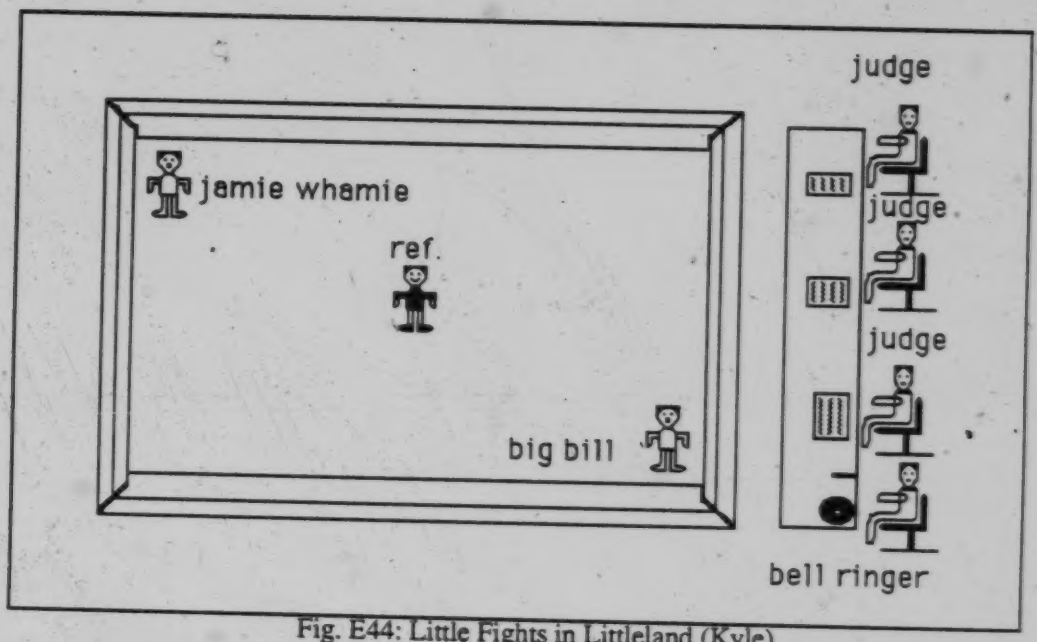


Fig. E44: Little Fights in Littleland (Kyle)

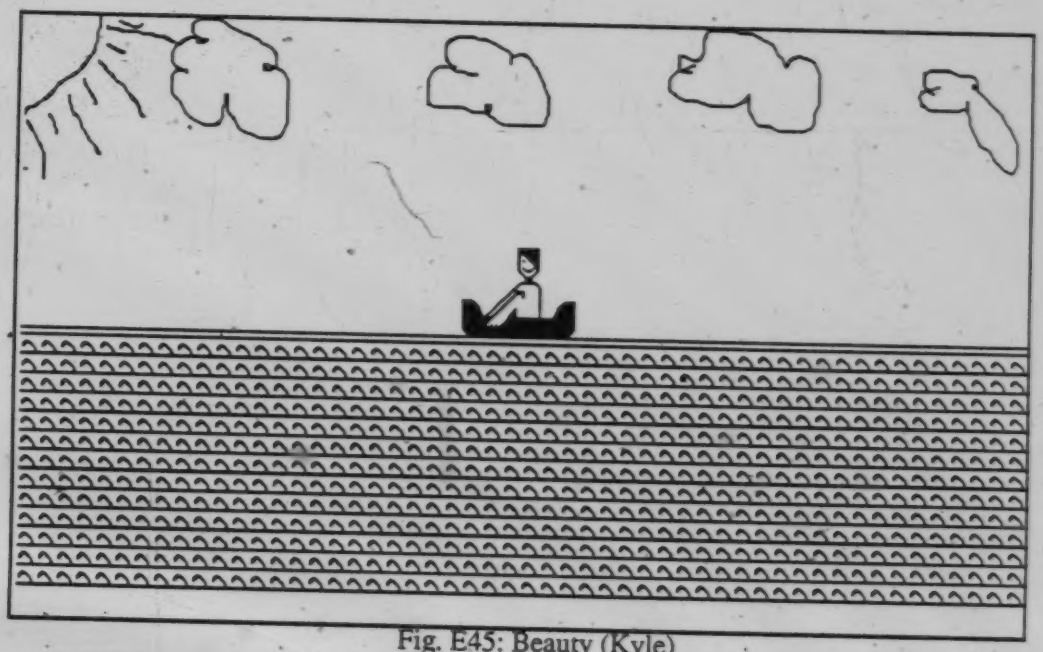


Fig. E45: Beauty (Kyle)

CHAPTER FOUR

Secondary Art Students

All quotes are taken from the student's responses to the questionnaire or essay in Appendix C.

Introduction

Students of an Art 30 class in a large Edmonton high school agreed to participate in this study for two weeks using Macintosh computers and the MacPaint program. Assistance was constantly available on the technical aspects of using these computers, with only one expectation put on the students; that they should attempt to use the computers as an extension of their art program and to experiment freely, making comments openly about the joys and frustrations of the encounter. Comments were gathered by way of a questionnaire, in-class notes, the art work itself, and a final one hour group discussion.

The approach of senior high art students to using the computer was decidedly different than that of the younger students. The sense of abandoned adventure experienced by the younger students was replaced by fairly specific determinations of what the computer should allow. What was immediately apparent from these older students was that they had built up personal skills and understandings of how certain materials responded; they were not going to compromise this knowledge without a great deal of resistance.

These students were all volunteers within the study in the sense that they were given the option of continuing with regular class activities (which were spoken of very positively) or participating in a look at what art on the computer might involve. Students understood that they were expected to stay with the computers for two weeks and that they were to provide copies of all of their work to the researcher and the Art Teacher. Overall, the students were very enjoyable to work with, displaying a great deal of good humor as well as a number of insightful reactions to this particular type of drawing experience.

On the first day the students had a demonstration of the basic functions of the computers such as starting, stopping, saving, loading, disk care. Once the MacPaint program was made available, instruction was limited to showing how access was made to each of the tools and what effects they produced. Students had the remainder of the class to try out the program on their own.

Early into this first class, the sounds of "Oh no!" and other expletives could be heard from around the room. From this early moment students seemed to decide they were either open to learning what this program could do to or for them, or else they seemed to decide that they wanted nothing more than necessary to do with these machines. Only two students seemed genuinely upset with the computer's reactions. The majority of students were content to see what they could do. Students were reminded to save their work often and to ask for help anytime they needed it.

The Students

CARL

Carl did not attend all of the classes and therefore has created a limited number of examples. He spent most of his class time concentrating on the perfection of a single drawing, the yacht in Figure S1. This drawing was somewhat difficult to make as the computer screen would allow him to only see about 40% of the image at any one time, making any long lines difficult to direct.

Carl has a preference for painting and drawing with an appreciation for the subtleties that paint and lead provide. He is a serious student and concerned with getting on with the task he has given himself. He has taken little time for experimentation, preferring instead to explore the computer through application.

HELEN

Helen has generally found drawing and painting to be enjoyable. She is quite motivated in her art classes and seems to feel very competent in her work.

One of the features Helen stated as desirable in the MacPaint program was the ease with which mistakes could be erased or corrected. The use of the mouse and its erase functions allow for the easy removal of sections of a drawing or the eradication of the entire image at one time. In this sense there was no feeling of being compelled to stay with an error and make the best of it, or even to allow it to alter the image, since it was usually easy to undo the last entry without any indication that it had occurred. This ease in correcting was certainly not the case with either pencil or paint and the knowledge that these corrections could occur had a definite effect on the manner in which work was conducted. Helen felt the computer would "cause me to draw sloppier because I know I will be able to go back later and correct it."

There were some frustrating aspects mentioned by Helen. These included the inability of the user to see the whole picture in detail without having to send it to the printer. Restrictions on access to the complete image were mentioned as problems by most students, and certainly are understandable in an area of study where the image is deemed paramount. Picture size was troublesome in another way in that it precluded the maximum size that was allowed for the drawing. Whereas picture size had a definite limit within the use of MacPaint, it should be seen partially as a software limitation, since other programs allow for a change in size (through scaling) that exceeds the boundaries of the drawing area. Nevertheless, there is a more important question here than just that of physical limitation. The confinement of the image within the computer work-space tended to aggravate many students when they just wanted to get up and move around the drawing.

Helen noted the positioning of the mouse to the side of the computer was a little awkward. This difficult positioning tended to change the established relationship between hand and eye in the accomplishment of a task such as a personal craft. A further physical

nuance is the scaling of the hand movement to the screen image. Depending upon the tracking of the mouse, screen size, and drawing program, moving the hand 10 centimeters on the table might produce a line of much less or more length on the screen. This easily creates problems in the closing of fine figures or intricate connections.

In comparing the computer image to that made with a pencil Helen indicated that the computer-held image was "more precise, clean and crisp." She also stated that it had "a more professional look" than her own drawings on paper. It appears this professional look has a lot to do with the reproductive nature of the drawing, giving it the look of a magazine, or from a professional printing studio. Again she states that where "a pencil/eraser is used the picture does not look as clean/clear."

In her essay Helen stated that features such as magnify and the *undo* key enabled her to further acquire a controlled look to her work. Such use of these built-in features were deemed to be an "extension of a person's talent" since "only a person can control the computer."

Figure S2 shows a drawing in which Helen has taken advantage of many of the MacPaint features. The drawing relies on large single-filled areas that utilize the high-contrast set of textures. This sharpness is softened with a half-screen effect on the edges which works well to compensate for the lack of tone in the white areas. The drawing took several classes to complete and, like all full page pictures, was constructed in stages rather than with long sweeping lines. The final look was very pleasing to Helen, giving her a strong feeling of satisfaction with the process.

Her other drawings in Figures S3 and S4 were not as encouraging to her. The picture of the elbow was intended as part of an assignment in biology class and lacked the visual impact she had hoped it would provide. In consideration of the amount of work that would be necessary to complete this picture so that it became more effective, Helen decided the task demands were out of proportion for the relative unimportance of the assignment.

The patterns in Figure S4 were the result of some experimentation in the use of the filled shapes tool and are typical of the type of computer experimentation many students worked on for large amounts of class time. This experimentation differed from the elementary approach in that with the younger students this experimenting seemed rewarding in and of itself. With the older students it appeared to be more of a way of developing, or even stumbling into, something more worthwhile.

JANE

Jane enjoys painting and drawing as a challenge in their own right, bringing to the activity a desire for experimentation. In the same sense she found the use of the computer satisfying because of the variety of possibilities it held in respect to the technical effects. "I enjoy the broad range of variety in techniques," she suggested.

The range of tools that are offered in the drawing program also caused some consternation for Jane. Going one step too far or proceeding without adequate checks sometimes created effects that were highly undesirable or outright destructive. Whereas the possibility often did exist to make corrections, either the lack of knowledge, or the frustration of having to deal with technical corrections at precisely the right instant, were discouraging. She stated that

> the computer is very fragile, and a week's work could go out in one mistake. I noticed that if you overload on the patterns your picture will be ruined or lost if you don't "Save As..." every 10 to 20 minutes. A detailed picture can easily be destroyed if the patterns, shapes, etc. overlap.

Many student efforts were lost or altered in this manner and consequently this is not an isolated criticism. This risk of losing everything may be one of the factors which contributed to the desire to get as much mileage as possible from all of the images, many of which are repeated or duplicated with minor changes. As can be seen in Jane's Moon and Tree pictures (Figures S5 and S6) very little has changed except for the fill patterns. Duplication and alteration will be seen over and over from most of the students and implies

more than simply designating all of these variations as complete pictures. In fact, with the abundance of variations in images, it was often difficult to ascertain when many of these images were in fact complete, and the images therefore appeared incomplete from a conceptual standpoint, sometimes just stopped due to limitations on class time.

Jane mentioned that the mouse could be assigned the role of a drawing pencil, yet failed to perform like one. With restrictions on the screen interpretation of hand movements, the computer didn't really offer the subtlety of lead. The physical object (mouse) was also somewhat cumbersome, requiring more exaggerated movements than the pencil would. In fact this was easier controlled by using a wider computer line to assist in detailed work; "...the thicker the line the easier you are able to control it." The trade-off, of course, was that with the increased ease in drawing by using bigger lines, there was an actual loss in detail. In order to avoid frustration it seemed necessary to compromise.

When Jane was asked to compare the finished image to that which she would have produced on paper, she remarked that there was a look of over-precision or harshness to the computer image. "A sketch on the computer is too precise and therefore it doesn't look realistic." Figure S7 is a good example of this harshness, the softness of the night blackness replaced with an overbearing solidity that stifles the picture.

Jane's pictures of the moon and the tree, Figures 5 and 6, also showed this over-definition of the textures that were meant to emphasize the night sky. Instead there seems to be produced a textile-like background which is not accommodating to the rather obtrusive egg shaped moon. This was the result of selecting the built in features of form and fill-in, an enticing manner in which to complete a fast picture.

There was a strong tendency for all students to take the quick way out at times and opting for the quick was often an abdication of control over the image. If the user sought this quick approach there arose a usually unstated question of when to assume control again. Some students assumed more control when the computer could no longer do it better or faster.

Jane's next comment must be interpreted as referring to human "flaws" in a positive light, suggesting a lack of stringent precision was more desirable. "On a sketch with a pencil however, you are able to make crucial flaws so that you have a much softer and a more realistic drawing."

Jane was one of many students who felt that the computer's supply of patterns and geometric shapes actually inclined the user to increase experimentation. There was also a suggestion of more efficiently managing to accomplish the task of drawing: "you are able to choose patterns, circles, squares, and other fascinating things which in turn make your job a lot faster and easier."

One of the positive references to the experience was in noting that mirror images were now possible giving the artist more selectivity in managing the picture than was otherwise possible.

Jane summarized the two weeks as "frustrating, but enjoyable." She saw the future use of computers would become a reality in the arts but hoped that "it will not take over the arts such as sketches, because I feel that the arts that a person drew on his own has a whole lot more meaning than that of a computer."

KATRINA

Katrina stated that she had hopes of making a career in fashion design and that her enjoyment of learning to draw was a reflection of this desire to prepare herself professionally by acquiring necessary skills. The computer was seen as a tool of the future and any associated abilities with it on the part of the user would only result in a competitive edge in the long run.

The computer was seen as offering almost unbridled potential, its use being limited only by the "operator's imagination." The student's frequent and easy reference to the user as an operator was probably the result of conventional social use of the word yet reflects

the readiness to assume a technician's stance. Katrina didn't hesitate to point out the many advantages of using computers over more traditional materials in art.

Two aspects which did cause some criticism from Katrina were the awkwardness of the mouse and the placement of selections within the software package. The MacPaint program offers many choices in patterns and image manipulation. The option selection could be achieved by quickly moving to an icon, clicking, and then continuing. This rapidity often resulted in the wrong action being taken and "the picture erases or you fill it with a texture or color you don't want, with a pencil this doesn't happen."

Katrina found that the computer slowed down her work, partially, she assumed, because of her lack of experience with it. The computer also was more cumbersome than regular material use. These were problems that could be eventually overcome and did not overly limit the value of the computer's role in art.

Katrina spoke of the "professional" appeal of work from the computer and wealth of texture and options it offered. The professional look can be partially explained in terms of the look of finality of the lines. There are no indicators of chance or error if the user wishes to hide them. "With pencil/paper you can smudge it, not have lines perfectly straight, basically things look messy and might even take longer than if you used the computer." She went on to state:

> With a computer there is more in terms of subject matter, I find that there is more variety and that you can accomplish more than with a pencil/paper. I find I had to draw things differently than I normally would on a computer because of the awkwardness of the mouse and the endless possibilities you can use whereas with paper/pencil *you are limited to what you can do*. (Italics added)

The last part of the comment is particularly interesting in that Katrina clearly states that her own limitations are not the deciding factor in the value of the work from the computer, that in fact the computer can either compensate for, or extend, her potential. This reliance on the computer for skills enhancement is also reflected in her following comment upon

selecting subject matter. "With a pencil/paper, you tire easily of limited drawing. With a computer you never tire of it because of the variety of possibilities."

Figure S10 shows a drawing that is under-utilizing the computer's special traits. The image is very much a draw and fill-in image, it is very flat. Figure S11 has the overall appearance of many of the drawings that are very much a disjointed rendition of images that might have appeared in a more cohesive manner on paper. There is a window which floats on a semi-transparent wall which is the result of experimentation with a wallpaper effect. A single geometric flower sits in a vase and becomes the focal point of the picture. The flower is constructed of 4 equilateral triangles, each filled with a texture to represent it in three dimensions, the bottom triangle being darker than the others. This selection of tones to allude to a raised surface is in contrast to the stark flatness of the floor, the wall, and the window surface. Were it confined to this or a limited number of pictures this would be of little consequence. On the other hand, one of the common threads that seems to bind all of these pictures together as computer-assisted pictures that there is a flat, stark treatment of most surfaces, easily provided by pointing and clicking. Figure S12 is really composed of 5 such surfaces with a minimum of contour added.

The belief that society generally, and the arts in particular, are moving rapidly into high-tech use is given as a rationale to justify getting involved in computer use in high school. Katrina felt the two weeks spent in this experience was very much worth-while but so limited in time that it only "scraped the surface" of the computer's use.

JOSEPH

Joseph has proven to be a more difficult student to understand than the others. This fact alone should please him as he has taken great pains to respond to even simple questions in a less than straight-forward manner. He enjoys "Illustration, sculpture and broadening (his) experiential horizon."

Joseph spoke of enjoying certain qualities of the computer in exactly the same terms that he used to explain what he disliked about it. He spoke of its "rapidity. The technical flawless execution. Its versatility and proficiency." These comments were in response to a question asking what aspects he found to be enjoyable.

When asked to state some of the more troublesome aspects of this experience he responded:

> The antiseptic, disassociative feeling; an impersonal contact; its obstinate graphical logic and systematic flow-chart processes; its lack of sensuality or joy in completion of vision; its monochromatic color grid; too many accidents and accidental pieces of 'good' work.

His work shows an amazingly quick development from using straight lines for visual effect, some sketching, and then to quickly centering on one of the technical effects, mirroring. His drawings are very accurate and were quickly executed, often without much change after their initial layout. His overall skepticism of computers was interpreted as a very sincere yet largely undefined wariness of both the machine and the society that produced it. His superior quality of drawings was accomplished as much as a means of mastering "the beast" as it was from any gratification from the process itself.

Joseph did excellent, interesting work while consistently warning of the perils of computer use. His comments were largely insightful and reflective, and, while sometimes very ambiguous, this ambiguity was accepted as a lack of clarity on a very sophisticated topic. In an attempt to help clarify Joseph's position, many of his responses are presented below.

> A disjointed, discordant; no visceral, grass-roots jazziness, nothing. Again; that disassociated separation, the impersonal, distant mechanism.

Joseph was one of the few students who asked questions of how the use of this technology could change him, how it might differ from other experiences. He frequently spoke of the computer image as existing somewhere other than where he was, as if it were stripped of his identity, "sterilized," and maintained in an impersonal and foreign place.

He saw fit to not only attack its compatibility with human need, but also to point out that even as a machine it was not truly flawless; "Due to the fixed-vector grid system, circles are not truly circles." More importantly, Joseph saw there was "No feeling of warmth or tactility in computer graphics images." It could be seen as only "FLAT. LIFELESS."

When asked to state whether there differences in the art work as a result of using the computer, Joseph responded:

> Yes. Geometry becomes prevalent, creativity is suppressed, intangible transformation becomes secondary to the mercy of the machine. Art is sometimes meant to counter-oppose or transcend logic, not cater and conform to it.

Recognizing the tendency to work in a geometric fashion caused Joseph to react by using the mirror capabilities in a less than obvious manner. Nevertheless he has concentrated on this aspect in a series of drawings. In the following picture of a skull, Joseph has clearly used the vertical centre mirror to create a symmetrical image. The picture is also balanced by the horizontal split. The priority of the image is maintained over the novelty of the technique. Joseph consciously attempted to prevent his drawings from getting too stylized, so that he found himself constantly trying to wrestle the computer. "I usually otherwise don't get annoyed drawing, dodging the ghost in the machine."

A quick look at the drawings of the Dragon (Figures S14 and S15) helps explain the sense of loss of sensitivity to the line, each line instead delivered with the same degree of importance. In the second picture shading is added but with limited success for Joseph. With a recognition of which effects are probably prone to failure, Joseph isolates the mechanics needed to accomplish some rather polished results and then proceeds to perfect their use. The result is the drawings from Figures S16-21.

Joseph's comments cannot be taken at face value, he is probably unclear as to what he really feels regarding the use of technology in his art. He tries to compromise his position in the following manner:

> Yes, again, it expands and contributes to experience, and yes, it is practical business practice, which is logical, catering to common sense, and despite my denial of such, it instills artists with common sense, bonding man and machine, his Frankenstein cyborg, with an odd, conceptual marriage of the art and science schools.

When asked if there were any final comments he would like to make regarding the computer, he answered:

> No, not at this time, really. You can't take it fishing, you win all your arguments, and its not as lazy as I am.

MARGARET

Margaret was on of the more articulate students in this group. Her comments were very sincere and insightful, and her arguments usually well made. She stated that there were various limitations imposed on her drawing by the computer. Some of these were clearly not acceptable to her in the long run but tolerable, even interesting, in this circumstance.

Her expectation that the computer pencil or the computer brush should behave like an actual instrument was evident in the following comments:

> You're limited as to what you can do. It is hard to create something that looks painted. You can't overlap drawings, then fill them in.

Margaret made a comment that very nicely summarized the feelings of several students in regard to what the computer seemed to do *to* their drawing."The computer is an extension of the hand and the styles are already programmed in, therefore it's hard for a serious artist to develop a style." Margaret saw this programming as a presetting of the parameters under which her hand, her own techniques, could be allowed to develop.

The final image that is possible from the screen is understood by Margaret to have a typically polished look that is not necessarily acceptable to her.

> The computer picture will probably look sharp, neat, with distinct lines. A simple pencil drawing will tend to be more sketchy. A pencil drawing would tell more about the artist and his/her style.

In this sense, Margaret was saying what several other students had expressed regarding the lack of personal style and individual identity with the art work. This was not a suggestion of inferiority in the quality of the computer image but a statement regarding the integrity of this art work as representative of the specific art maker that initiated it.

> With a computer the subject matter deals more with perspective and diagrams (i.e. buildings). With the computer I've been very experimental, and I find that I can take the easier way out when drawing, because the computer can draw a perfect line, circle, square, etc... for me.

Margaret preferred both the look and the development of the hand-drawn picture over the computer assisted. The use of the term "experimental" at times seems synonymous with undirected, as if there was a tendency, or attraction, to work for the sake of working. There is a difference here from the notion of art for the sake of art in that it is not the concept that acts as a driving force, rather it is production in the absence of conception.

> (Computers take away some of my imagination.) The computer programs that we have been working with are in black and white. This limits the artist to color and directs you more to the texture chart that has already been programmed for you.

These statements further illustrate Margaret's conviction that the emphasis on her work is being altered from her own concerns to the technical problems associated with the computer. She illustrates this alteration in two ways.

First, she mentions the limits that are placed on her imagination. She no longer has free rein to develop an idea as she might. Instead, the conceptual aspect of her work is corralled by very definite structures which must hold her thoughts along a set line. Color might be desirable, even preferable, but out of reach.

The second alteration is the programmed environment which limits in a technical manner. Figure S22 shows a background of glass that is handled well for the material available. The glass reflections are not life-like, more imitation than realization, and the overall effect is somewhat flat throughout the picture. The jug too does not look 3-dimensional as much as it looks like it is *supposed* to be 3-dimensional. These

appearances should not be seen as weaknesses on the part of the student as much as perceived limitations of the program. Whether or not there are various means available to break out of some of these is really beside the point, since the common perception of the same creates the reality, student work tends to look flat and repetitive overall.

Many of the other pictures done by Margaret show an attempt to try out various effects. The mouth picture in Figure S24 is drawn largely with the air-brush and without lines. The bearded man in Figure S25 is painted with a brush, the perspective drawing of Figure S26 is made primarily of straight lines, and the Money Bag in Figure S27 is a use of the pencil and freely drawn lines.

Each of the previous pictures were possibly more easily drawn with pencil and paper. And they would have then been more believable in terms of shading and tone. But Margaret's last two pictures, Figures S28 and S29, are different. They utilize qualities of the MacPaint program that are unattainable on paper alone. In these pictures only one flamingo was drawn and then duplicated, inverted, flipped, and enlarged. Margaret made several variations of these birds before losing interest. The final picture S2 appropriately shows high-contrast forms in a field of flat tones.

KYLA

Kyla made the decision on the first day that she did not like computers and would therefore rather return to regular class. I asked her to stay for the two weeks assuring her that her opinion, even if negative, was deemed valuable. In fact it would help balance the viewpoints of the entire class. She consented and worked on the computer for two weeks. Most of her time was spent complaining about the stupid computer and from her own standpoint was probably of questionable personal value.

Kyla was not as strong an art student as many of the others, instead concentrating on various craft approaches. In fact when she listed those activities which she preferred it was evident that she really had very limited exposure to many of them.

> The art activities I find interesting are making things like rings, pottery, making plant holders, making those window panes (like the ones they have in churches) with all those different colors of glass. And I like drawing and I like a bit of printmaking.

Kyla appreciated the copy capability of the program as well as the ability to quickly erase from the screen. She seemed to be swayed a little by the overall enthusiasm of some of the other students in stating that it is a "lot easier to draw" with the mouse than with a pencil, but then quickly added, "That's in some people's eyes. But in my eyes its easier to draw with a pencil in my hand."

She then conceded that in fact it was difficult for her to draw with the mouse at all. "I'm just having troubles with this. Me and the computer don't get along very well."

Kyla experienced a great deal of frustration during this experience. She often commented on her belief that she could not "get along with" the computer. She found the mouse awkward to handle and was troubled by the small screen size and the confinements it presented.

Her drawings show a very uncommitted approach to the task overall. She has made a preliminary outline of an outdoor scene and then copied it and modified it a number of times to complete more drawings.

LANA

Lana did not have a lot of good to say about computers overall. She experimented enthusiastically and was one of the few students to seriously try and create visual effects similar to those she understood with more traditional means, e.g. she made a sketch, and tried to use the brushes in a painterly manner.

She enjoyed art overall and stated a preference for "painting, quick sketches, and detailed sketches." This experience with traditional media established a strong sensitivity to the visual/tactile effects of these materials, causing her to sense a loss of some vital component with the computer image. The computer offered other interesting possibilities

such as "the fact that an image may be altered or changed easily. The use of shortcuts, examples: flipping, duplicating, or mirroring an image."

Lana drew a small table separating the qualities of paper and pencil drawing from those on the computer. Among those which were attributable to paper and pencil she referred to the diverse tones and instantaneous reactions which were possible. It was easier to create textures and shading with a pencil, as well as being able to simulate "real life" more readily.

With the computer there was a more restrictive set of tones that could be used. Whereas some subjects looked more "professional" there was in fact a more "limited practical subject matter" to use. In other word for specific types of imagery the computer presents a more polished picture, but there is more versatility and subtlty to traditional materials.

Lana generally found art classes to be very sociable and enjoyable, where students interacted through discussion and assistance. The computer seemed to change this atmosphere. "Art is usually a very social class where people become very close as they discuss and evaluate each other's work; thereby learning from each other and supporting each other. With the computer it becomes a personal challenge to create something, with no communication of others."

Lana made two other comments. One had to do with a problem that was mentioned by about four other students. This was the problem of headaches. One student had so much difficulty that she often brought aspirin to class just in case.

The final comment was more serious in nature. Lana stated, "There is no personal style to be found with computers, everything has a sameness and can be duplicated easily." This statement was not presented as a possibility but as a statement of fact. In other words the limited experience already left her with a sense of limits, at least in respect to her own work.

MARILYN

Marilyn enjoys drawing, painting and sculpture. She was initially enthusiastic about trying out her ideas on the computer in order to experiment with the changes that would result from the new medium.

She quickly ran out of interest with the computer, preferring instead to get back to the materials that she understood and could utilize more fully. "As the days wore on, it got to be something of a drag." Her reactions were open and explicit, focusing on several aspects of computer utilization that particularly annoyed her.

Marilyn indicated her feelings in stating that the computer "is harder to control and you can't do a drawing and see the whole page at once." She felt the images that were produced lacked significance, that "Paper/pencil drawings look more real," and that she did not "feel as comfortable as I normally would be. Doesn't seem like real art."

The type of drawing she made was noticeably less involving for her than it normally would have been, her drawings now largely experiments in line and geometric forms. Marilyn stated, "I feel limited to subject matter. I have drawn only simple line drawings."

The nature of drawing was very important to Marilyn. The sense of enjoyment she received from these was altered radically with the computer, as if there was an activity taking place that had the name of art but was not similar in the experience. In her own words: "I feel I can't get close enough to this art. There is something separating the art and artist - not as satisfying."

ROBERT

Robert did not attend all of the classes and did not turn in a questionnaire response or an essay. For these reasons it is obviously difficult to fairly assess his approach to this experience. The drawings that he did make show a very interesting use of the drawing tool and the ability to duplicate the image. These three dragon pictures (S44-S46) are

progressive, illustrating an attempt at sketching, and then refining the picture. The third example is basically a modification of the second.

Robert's work is well controlled and only slightly indicative of his very fine pencil control in standard format. The computer clearly held little interest for him overall, although he did express satisfaction with the these particular pictures.

SHERYL

Sheryl enjoys drawing in pencil/charcoal and painting. The computer provided a change in emphasis from these materials that she found pleasant. The ability to copy portions of a picture and then to allow her to manipulate these portions in various ways, such as inverting and flipping, was spoken of positively. On the other hand these were not completely indicative of the overall experience. Sheryl found that the computer was demanding in some respects.

Although Sheryl was open about her feelings she did not seem to be fully consistent in her comments. Some of this inconsistency was attributed to a personal lack of certainty as to where she stood and at times it appeared that she was attempting to form an opinion on issues in which she was still undecided. This conflict was possibly as significant as the opinions she did express. She stated that "even art can be perfected by a computer," but then added that "art done by the human hand is still the only real expression of creativity."

Most of her positive comments regarding the computer were associated with a belief that computers were here to stay, that they have "become an important part of our society," and that she owed it to herself to become as familiar with them as possible.

In an attempt to look positively on the experience, she stated that some of the enjoyable aspects included the ability to "change things, mix different ideas, and make many copies of the same picture." There were a great many more comments to be made on the negative side.

Specifically, Sheryl pointed to the physical and conceptual restrictions which the computer imposed upon her. In this situation mistakes "could ruin the whole picture." To make this concern even greater , she felt that the use of the computer inclined her towards more errors. "It isn't possible to manipulate the computer the way a pencil can be manipulated," and this accounted for it being "difficult to make the switch to drawing on a computer."

Sheryl felt that personal pride in her work could "be taken from a drawing drawn by hand," but those components that encouraged pride, "personal creativity and style" could not be duplicated or created by a computer. One of the major differences between the two was that "a hand drawn picture has more flow and personal style to it."

Again in comparing the two, she said that a pencil has "a more exact choice of lines" and "a computer has a wide variety of instruments that work well together." This was understood as the pencil has more flexibility as a tool, whereas there are more tool options to select from on the computer. What the computer lacks in flexibility, it attempts to compensate for in breadth.

Sheryl made one of the few comments which blatantly said that the computer altered the art work. "It is difficult to draw freely a subject that by hand would come naturally. The computer does cause me to draw things in a harsher manner." This harshness was understood as a loss of subtly in line control and shading.

Sheryl experienced frustration in terms of the attack on visual problems. As she put it, "it takes a lot more to uncover an idea from my mind." There was an increase in effort in having to turn this concept into a technical problem, and then to solve it.

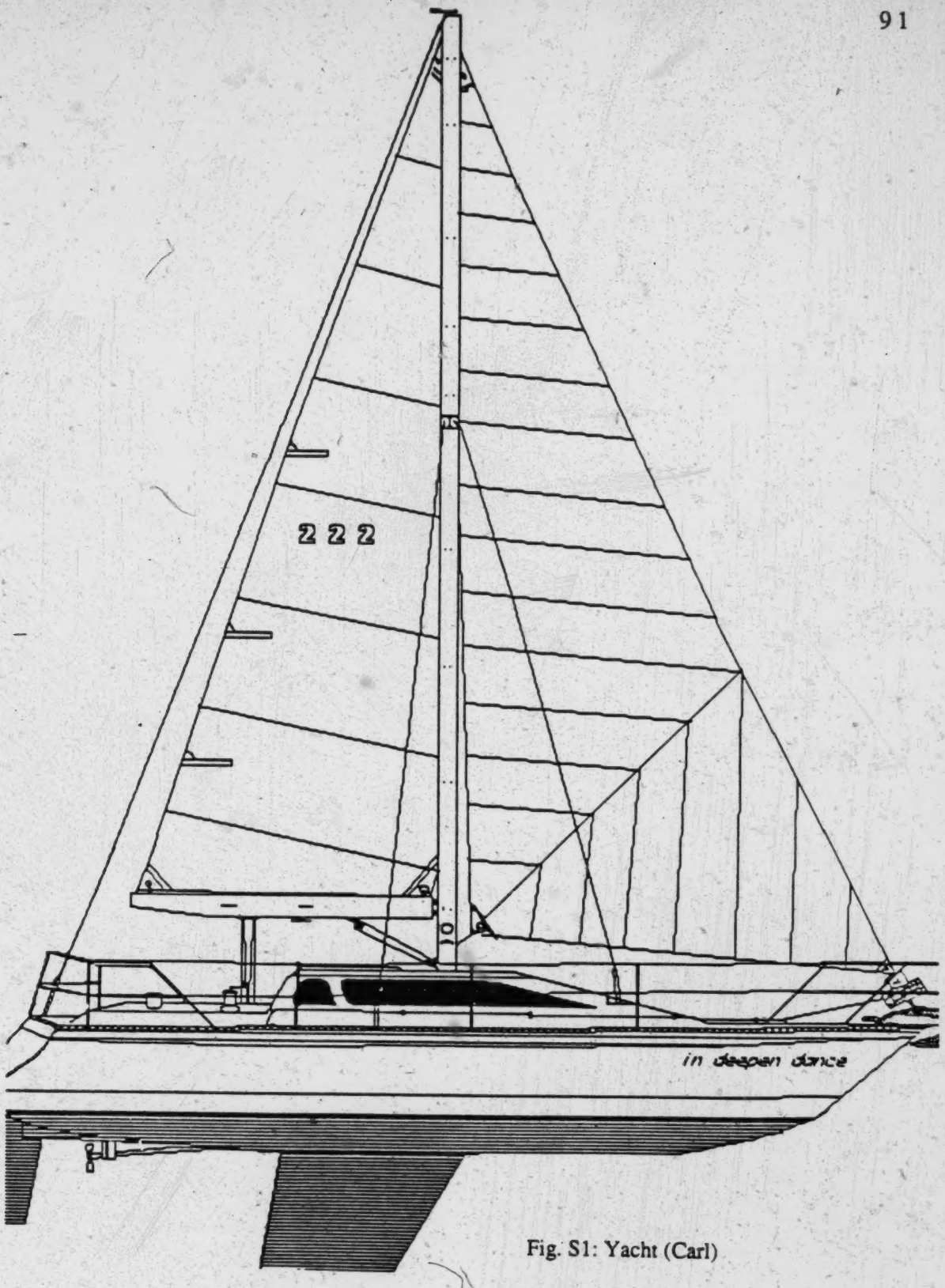


Fig. S1: Yacht (Carl)

Fig. S2: Lady's Portrait (Helen)

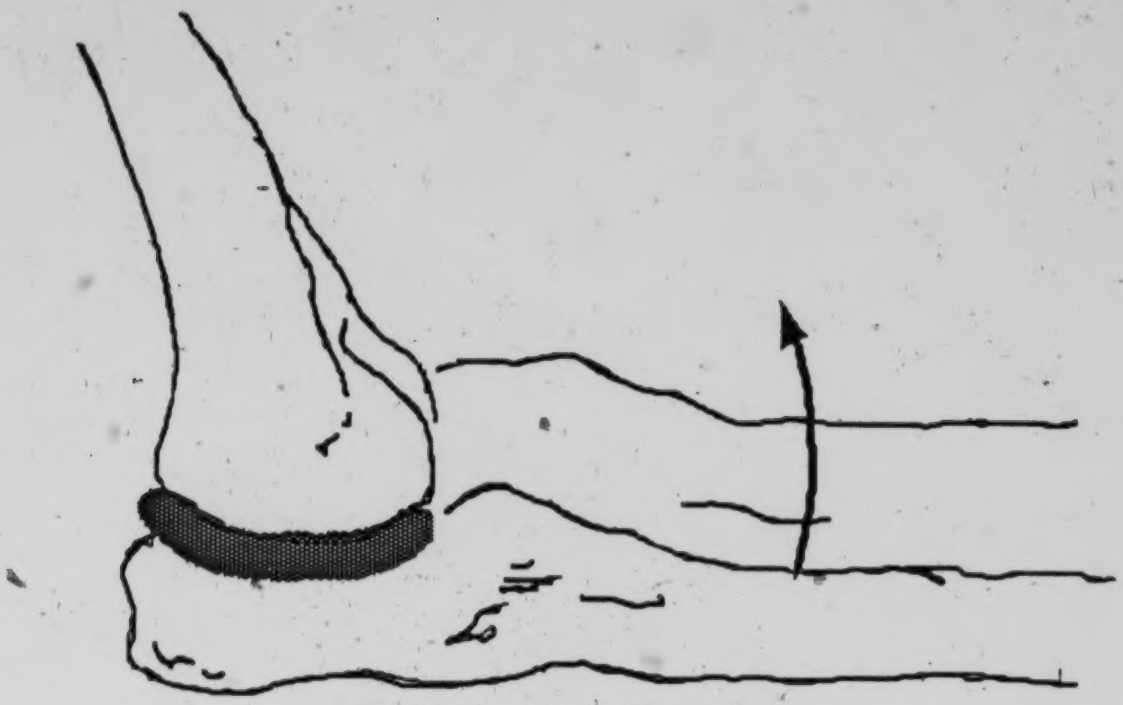


Fig. S3: Hinge Joint of Elbow (Helen)

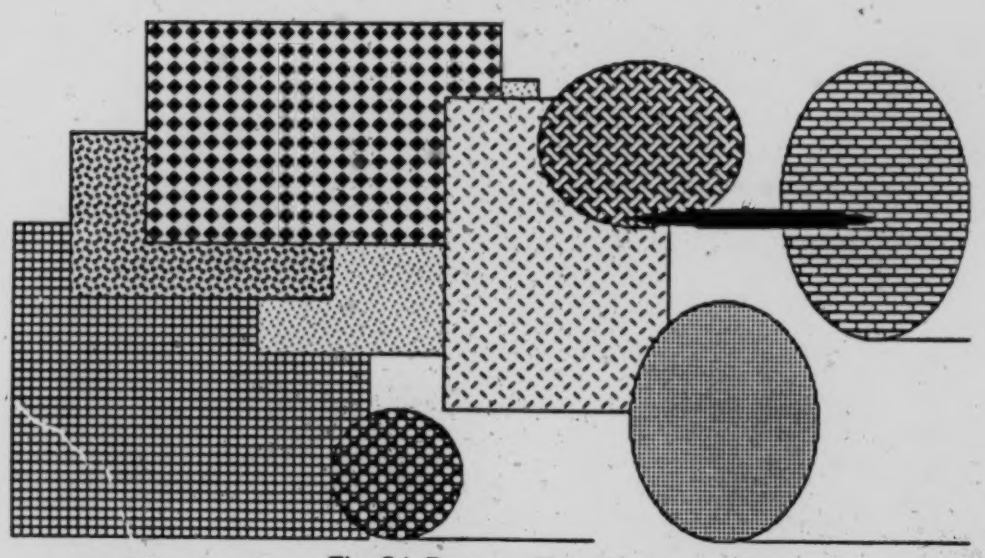


Fig. S4: Patterns (Helen)

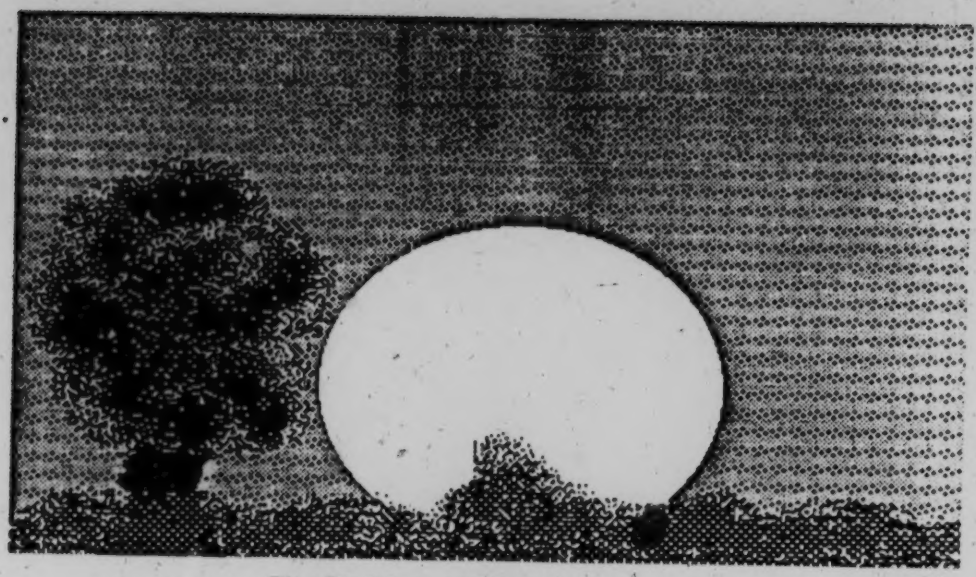


Fig. S5: Moon and Tree 1 (Jane)

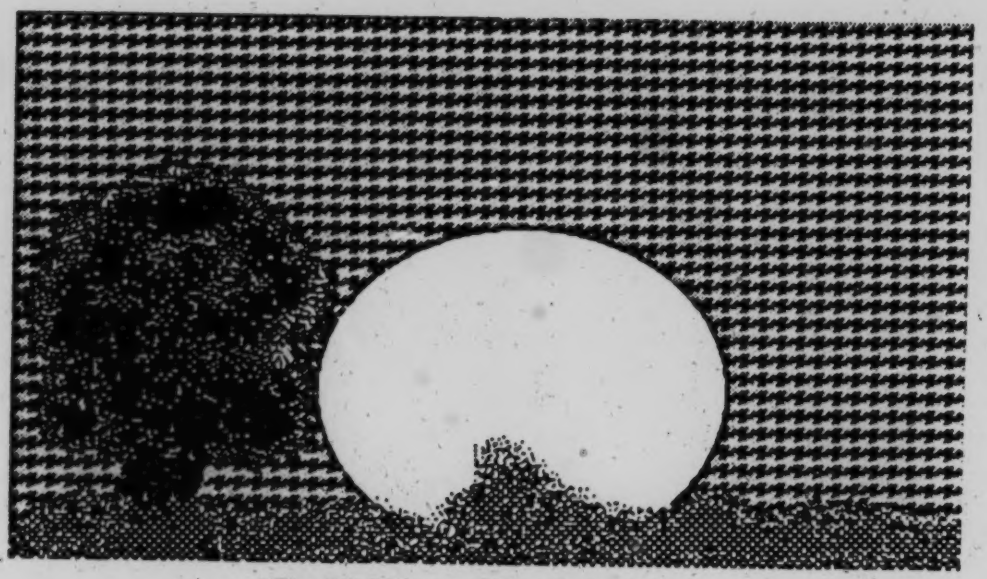


Fig. S6: Moon and Tree 2 (Jane)

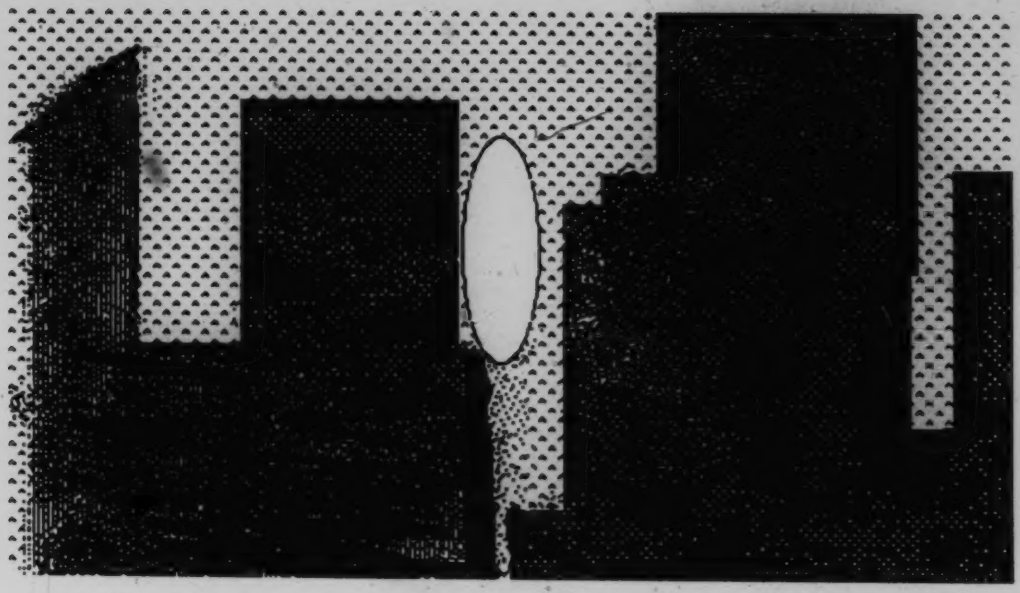


Fig. S7: City (Jane)

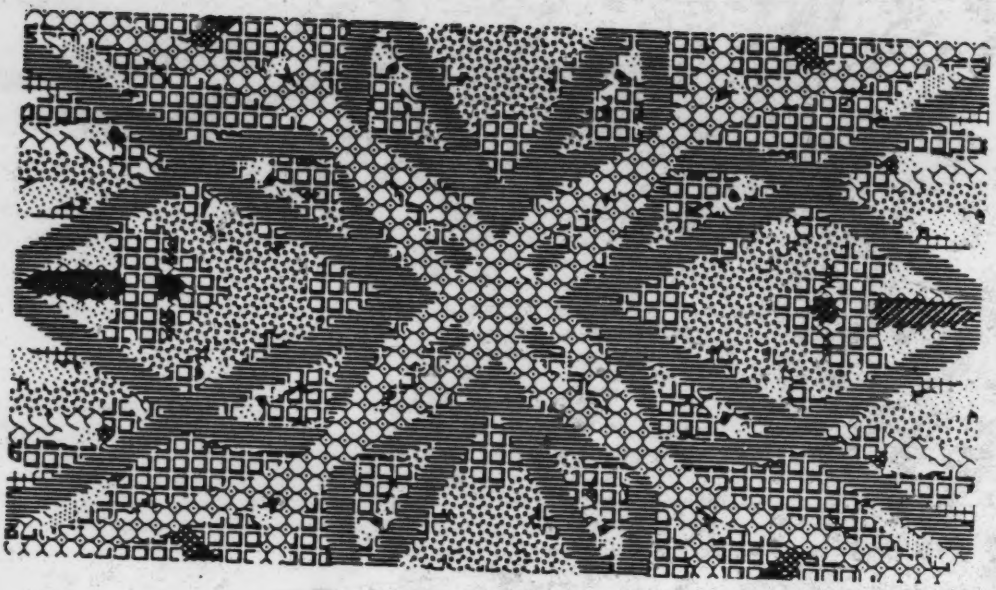


Fig. S8: Brush Mirrors (Jane)

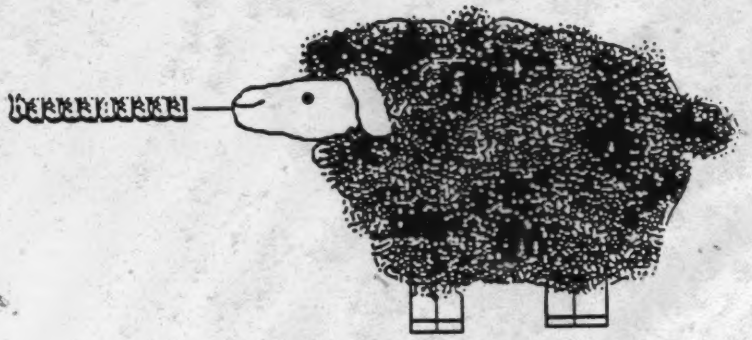


Fig. S9: Sheep (Katrina)

Fig. S10: Portrait (Katrina)

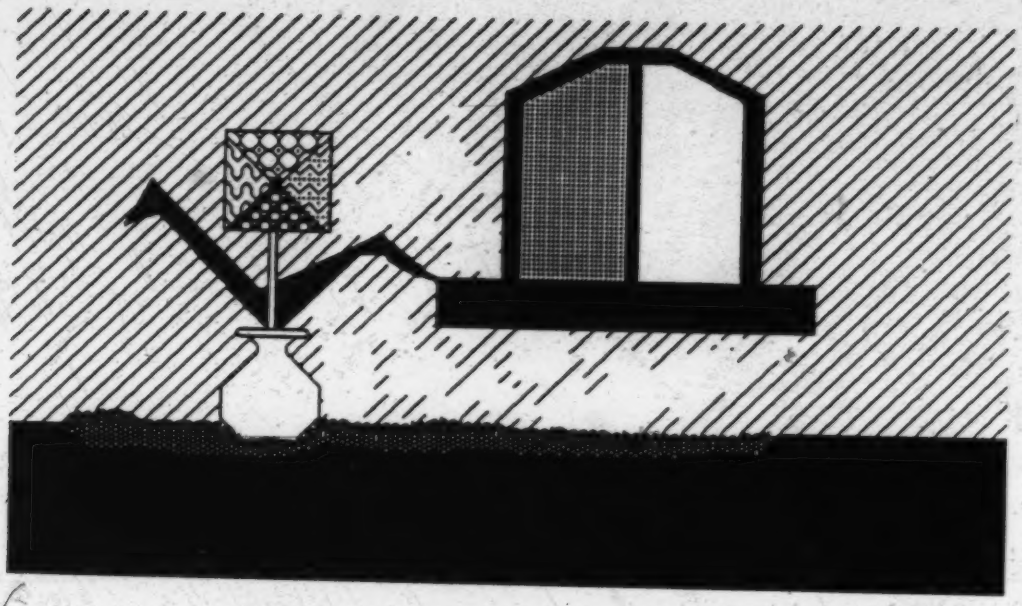


Fig. S11: Flower and Window (Katrina)

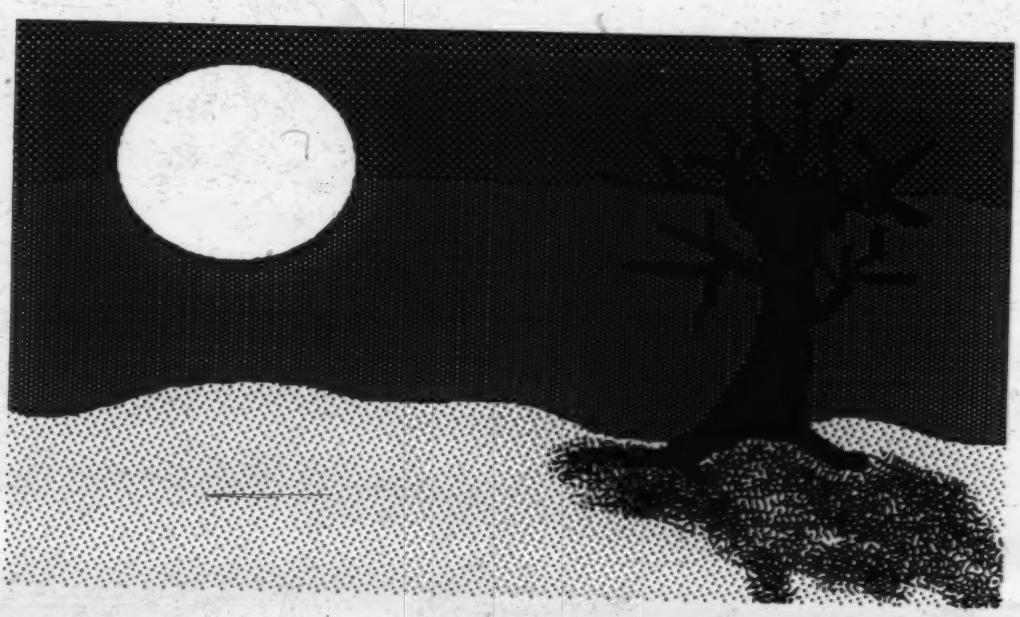


Fig. S12: Moon and Landscape (Katrina)

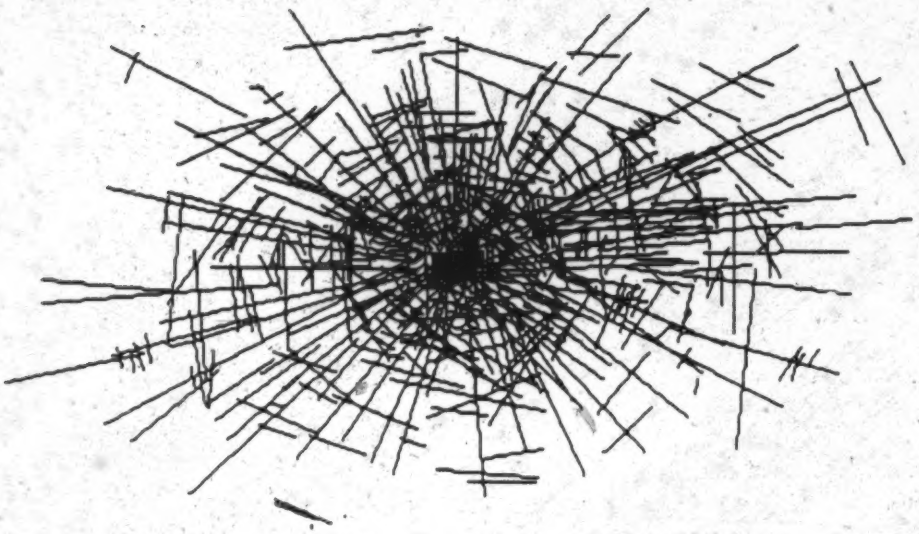


Fig. S13: Lines (Joseph)

Fig. S14: Dragon Sketch (Joseph)

Fig. S15: Dragon (Joseph)

Fig. S16: Skull (Joseph)

Fig. S17: Warrior (Joseph)

Fig. S18: Devil (Joseph)

Fig. S19: Creature 1 (Joseph)

Fig. S20: Creature 2 (Joseph)

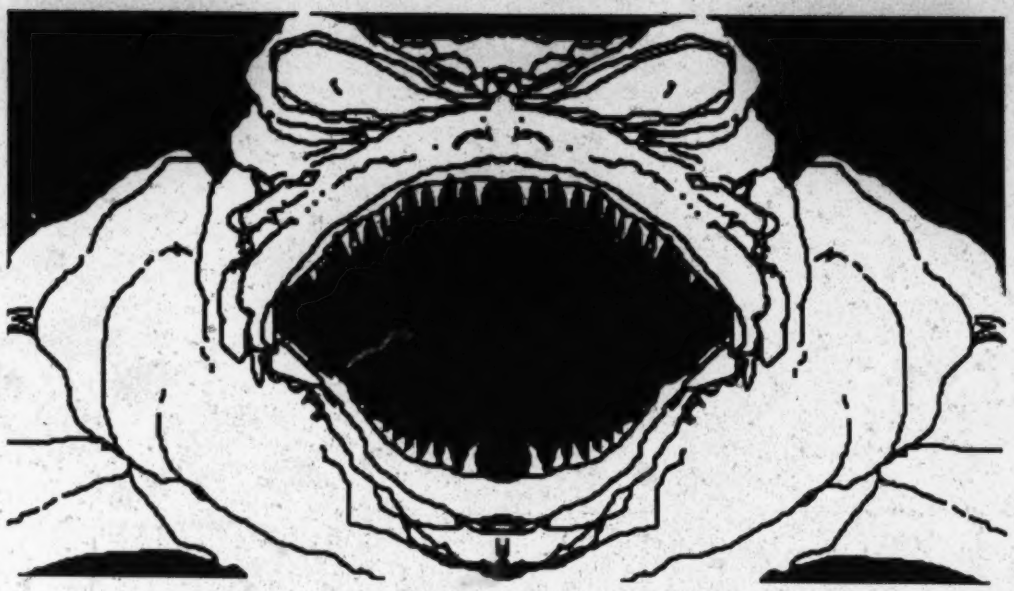


Fig. S21: Creature 3 (Joseph)

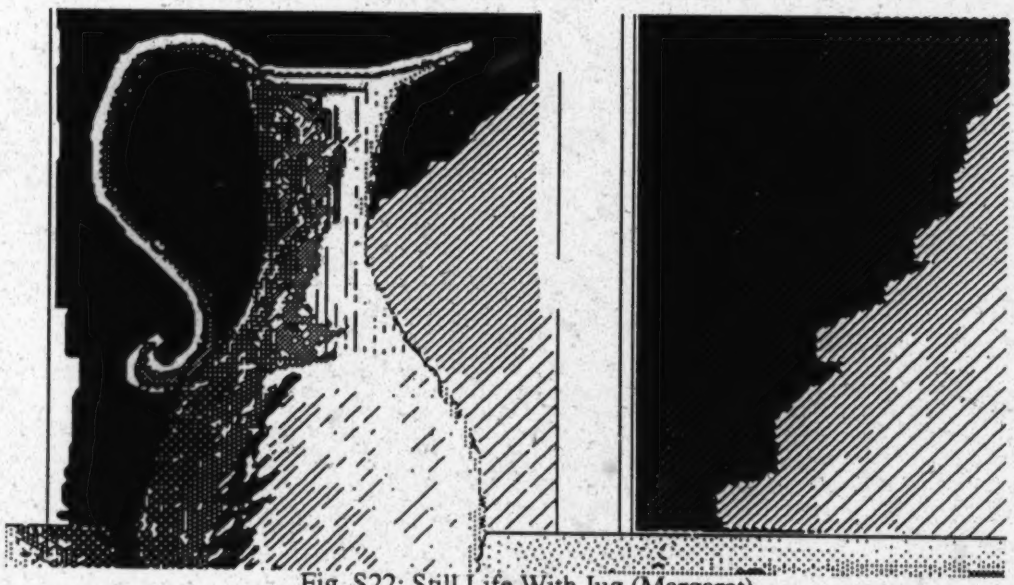


Fig. S22: Still Life With Jug (Margaret)

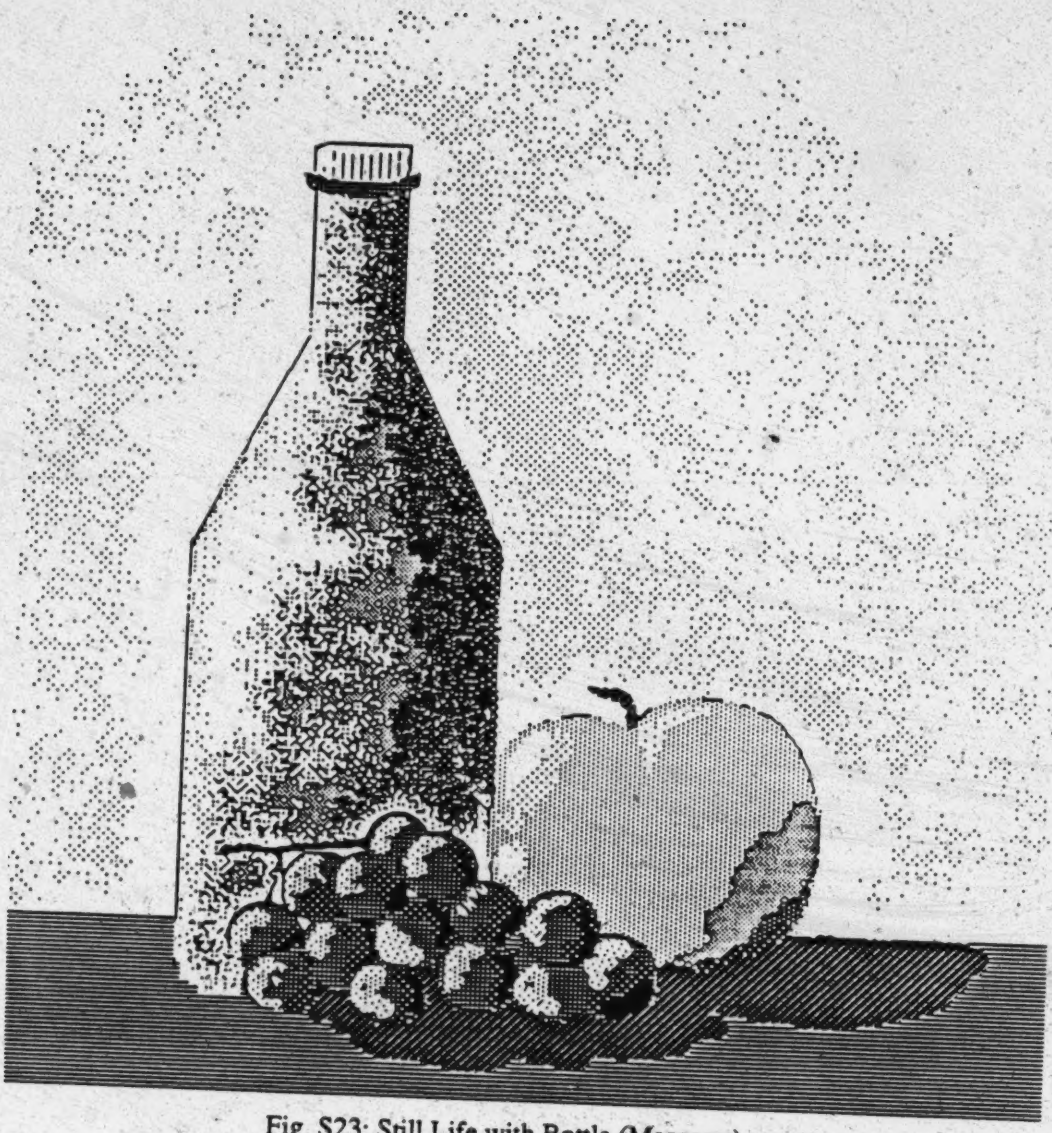


Fig. S23: Still Life with Bottle (Margaret)

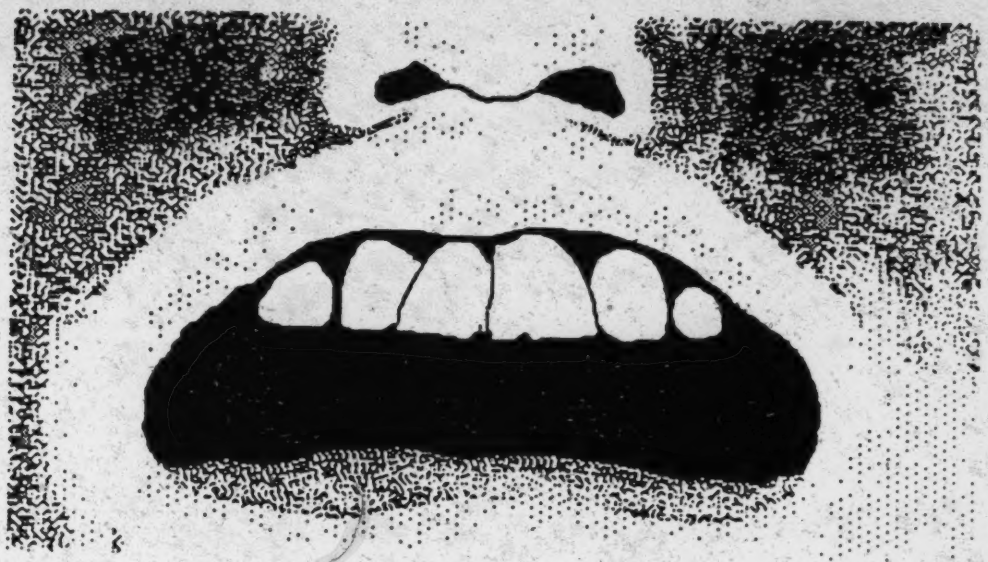


Fig. S24: Mouth (Margaret)

Fig. S25: Bearded Man (Margaret)

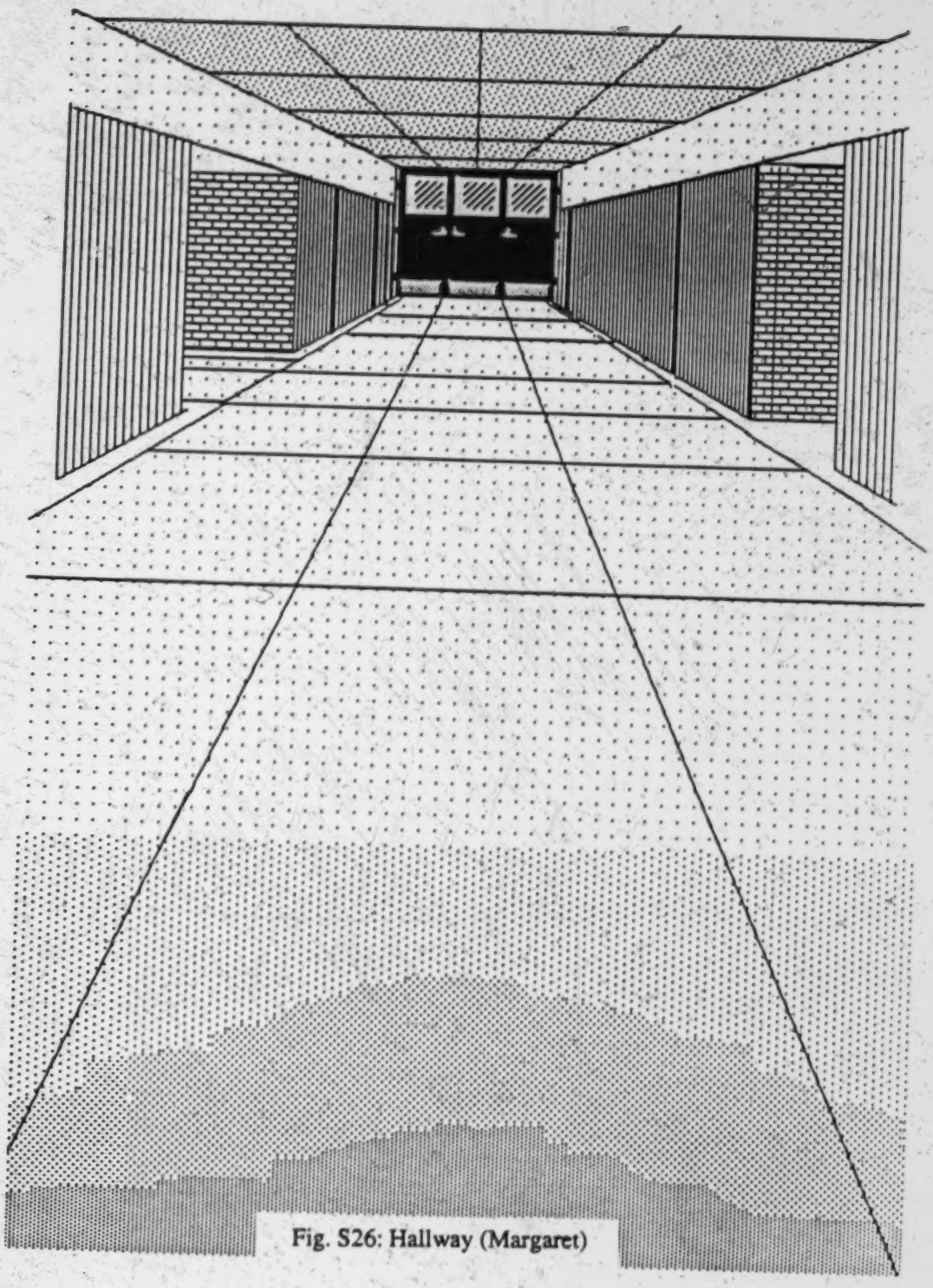


Fig. S26: Hallway (Margaret)

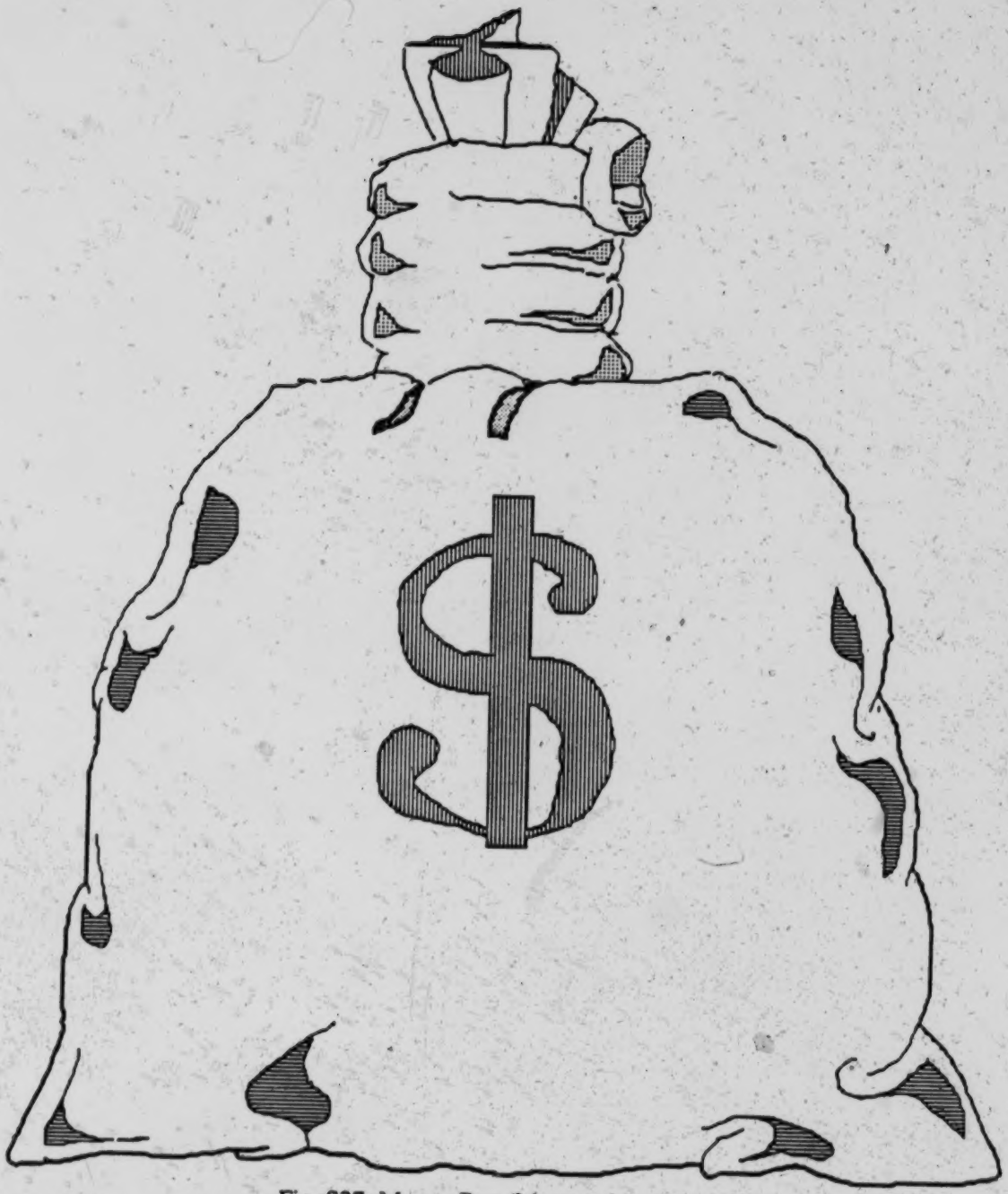


Fig. S27: Money Bag (Margaret)

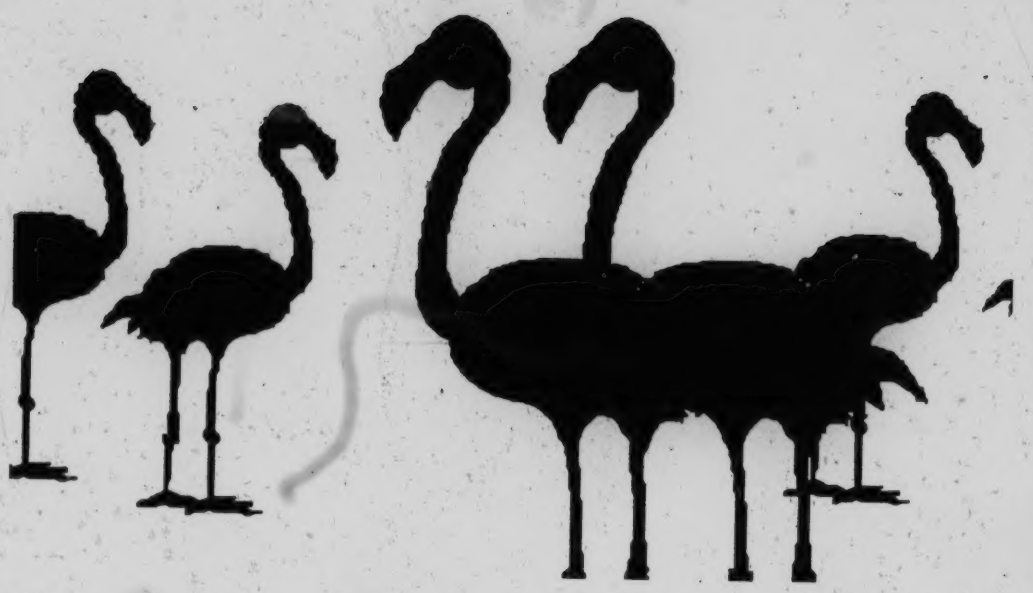


Fig. S28 Flamingos 1 (Margaret)

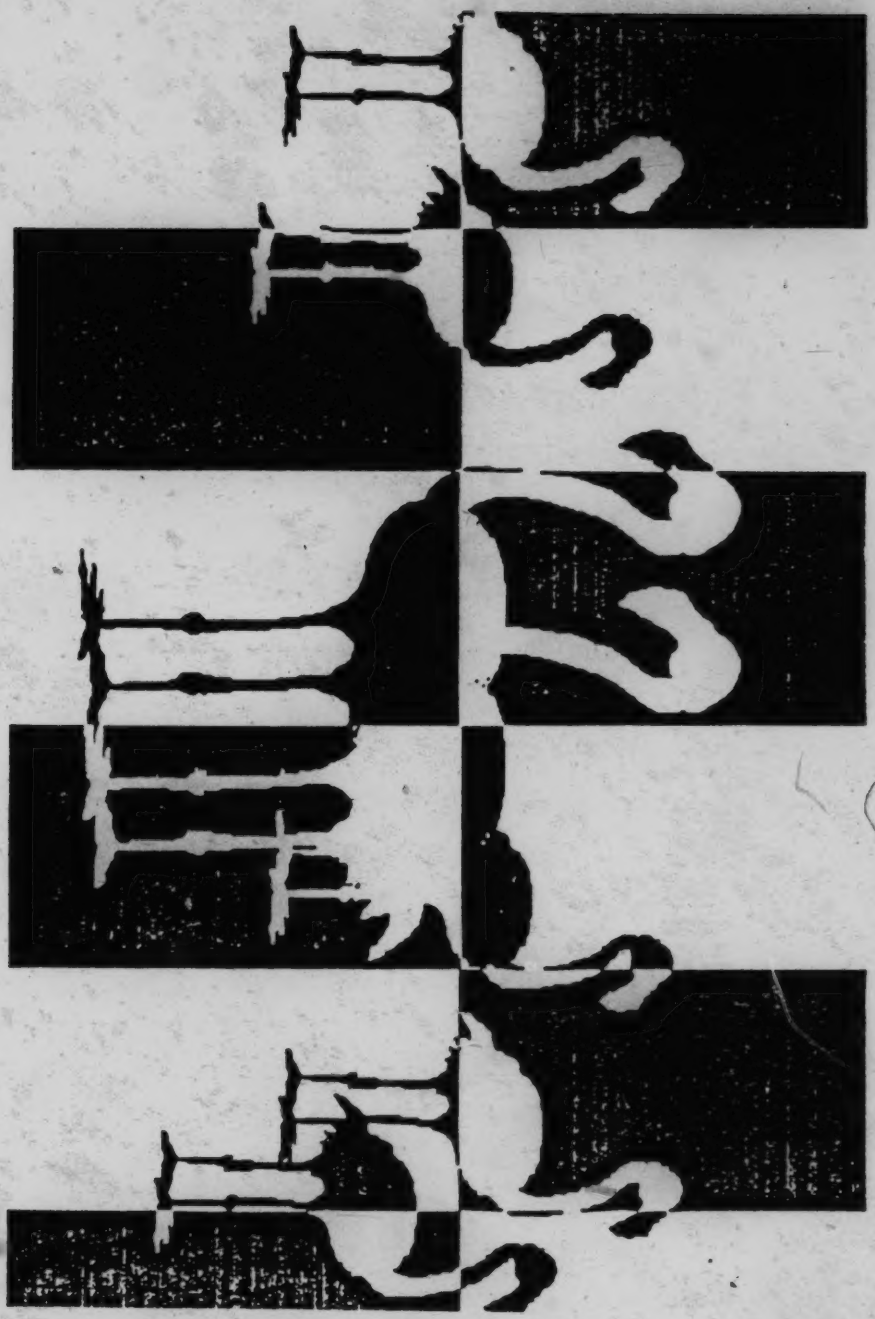


Fig. S29: Flamingos 2 (Margaret)

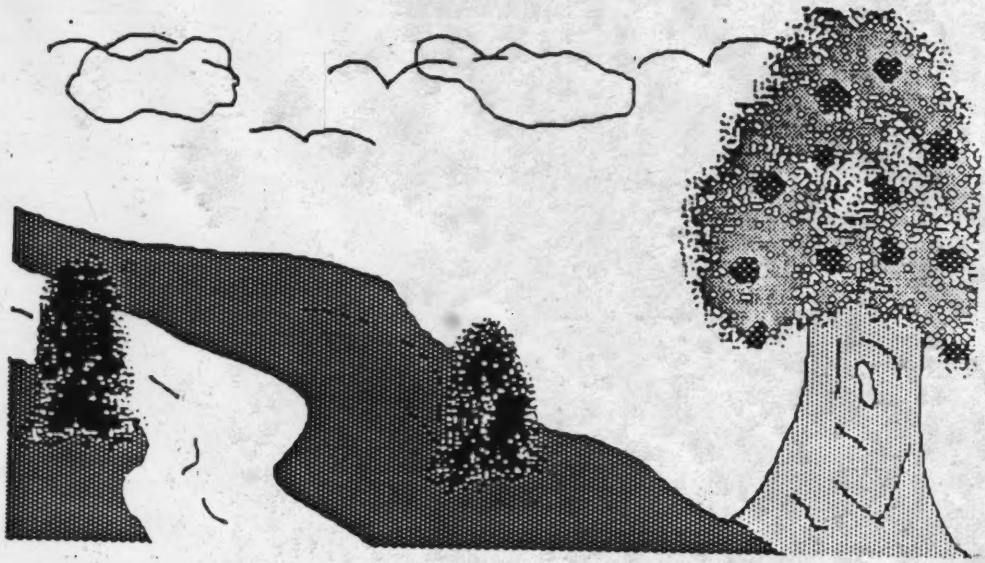


Fig. S30: Landscape 1 (Kyla)

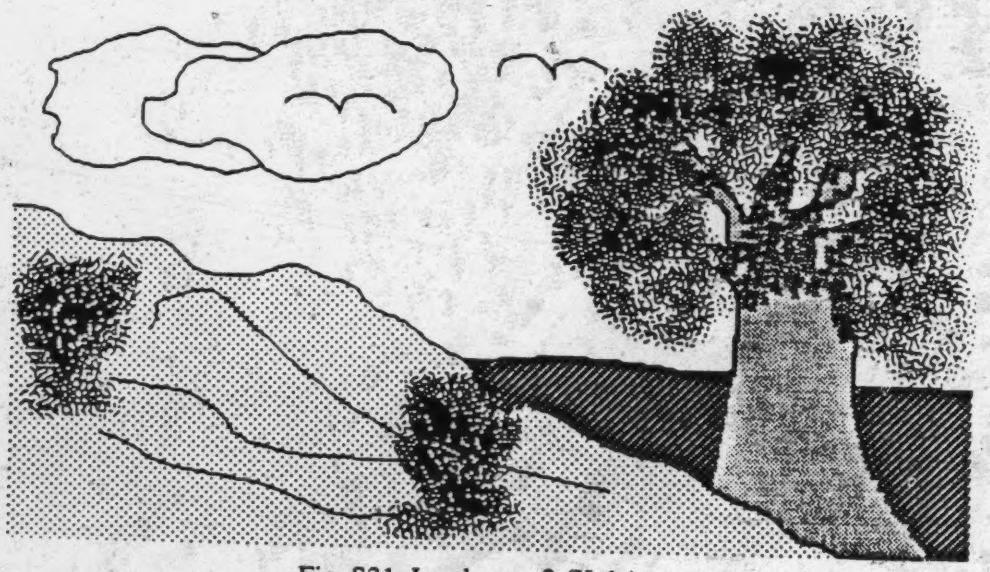


Fig. S31: Landscape 2 (Kyla)

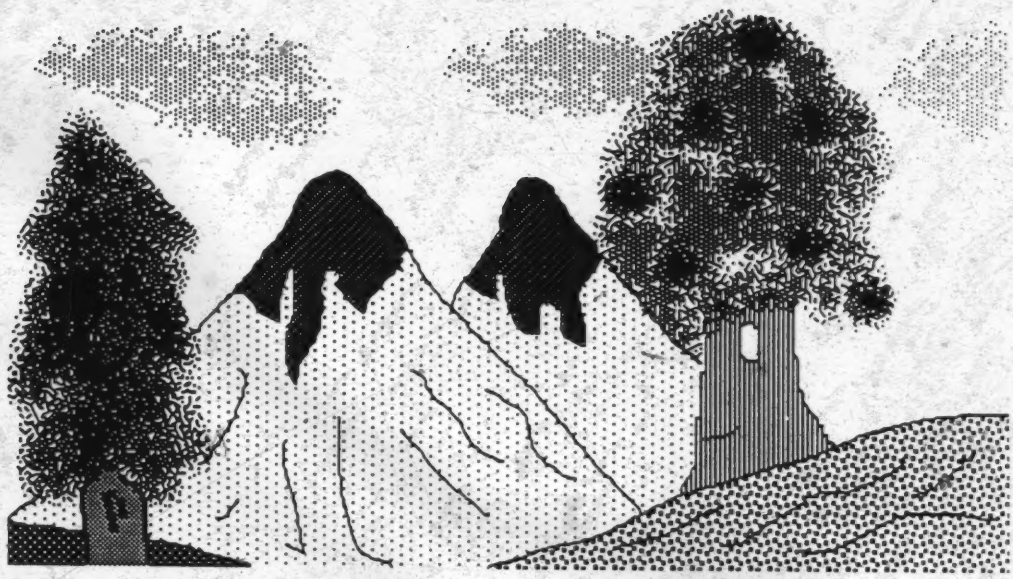


Fig. S32: Mountains (Kyla)

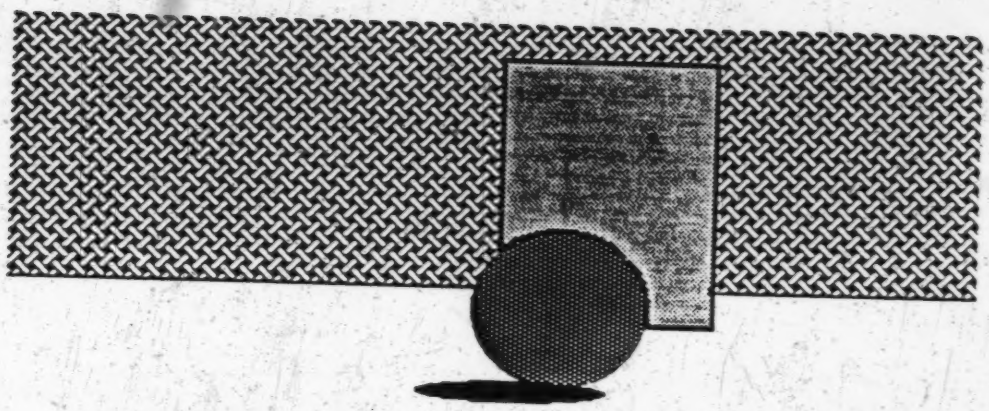


Fig. S33: Ball and Square (Kyla)

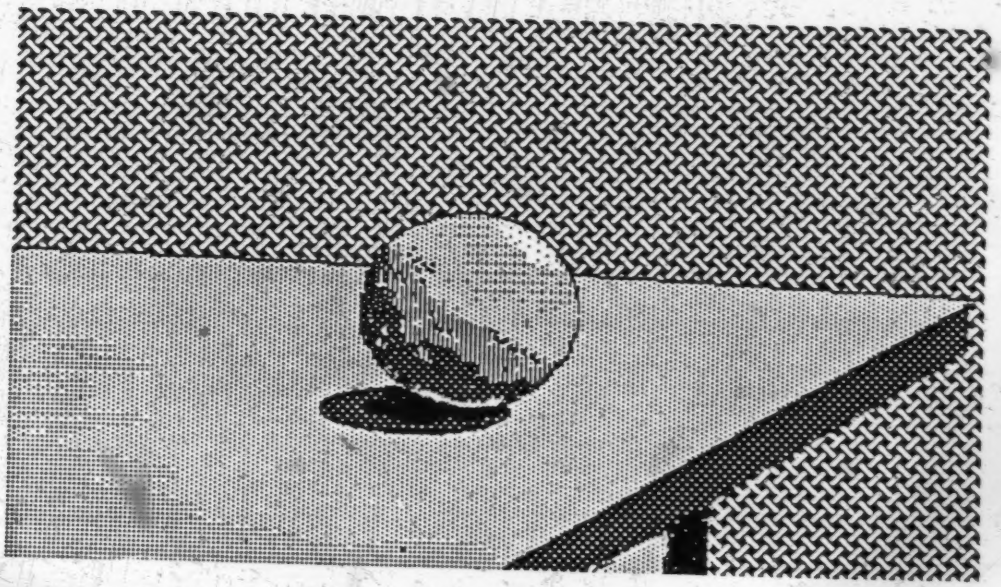


Fig. S34: Ball on Table (Lana)

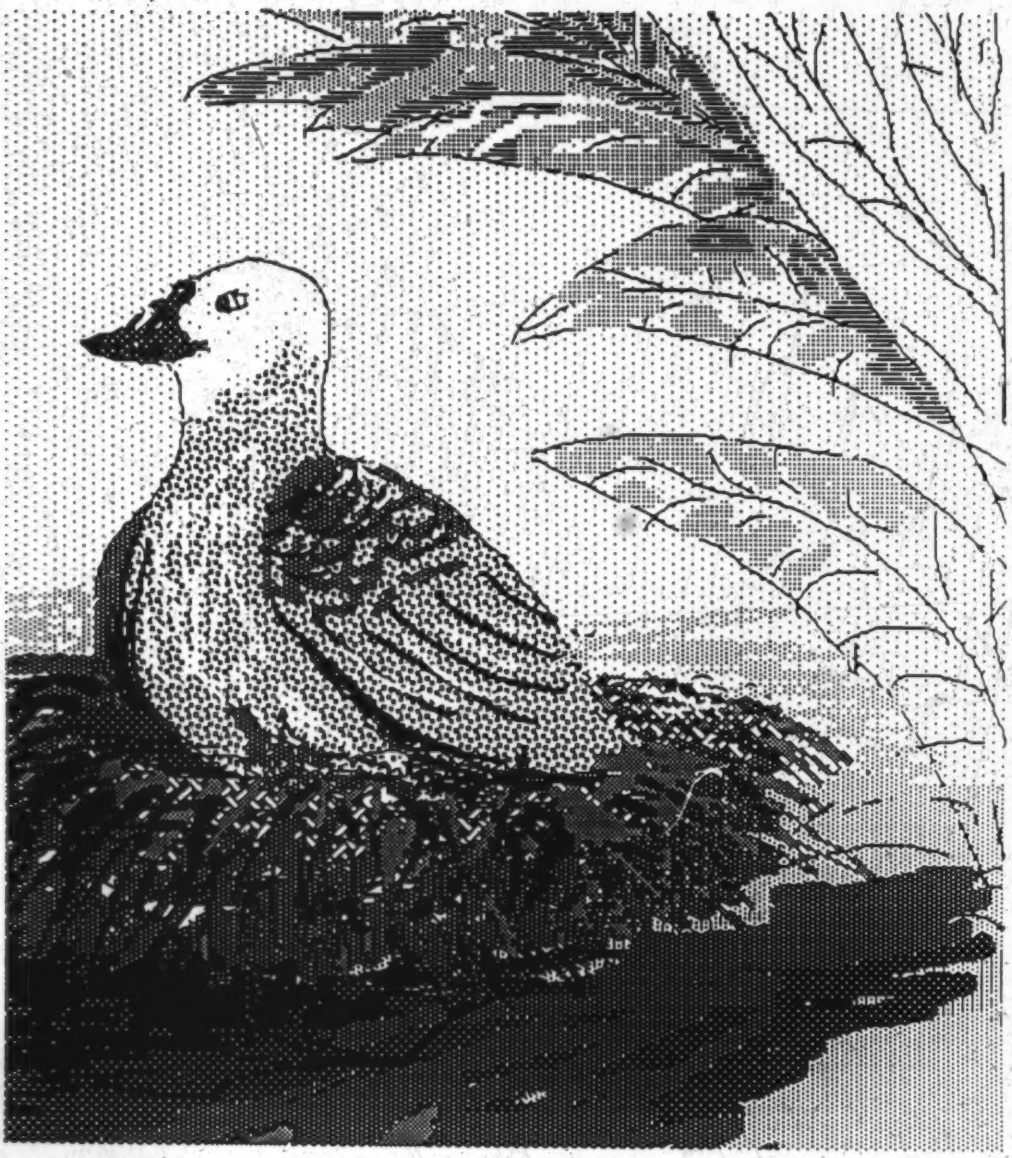


Fig. S35: Nesting Bird (Lana)

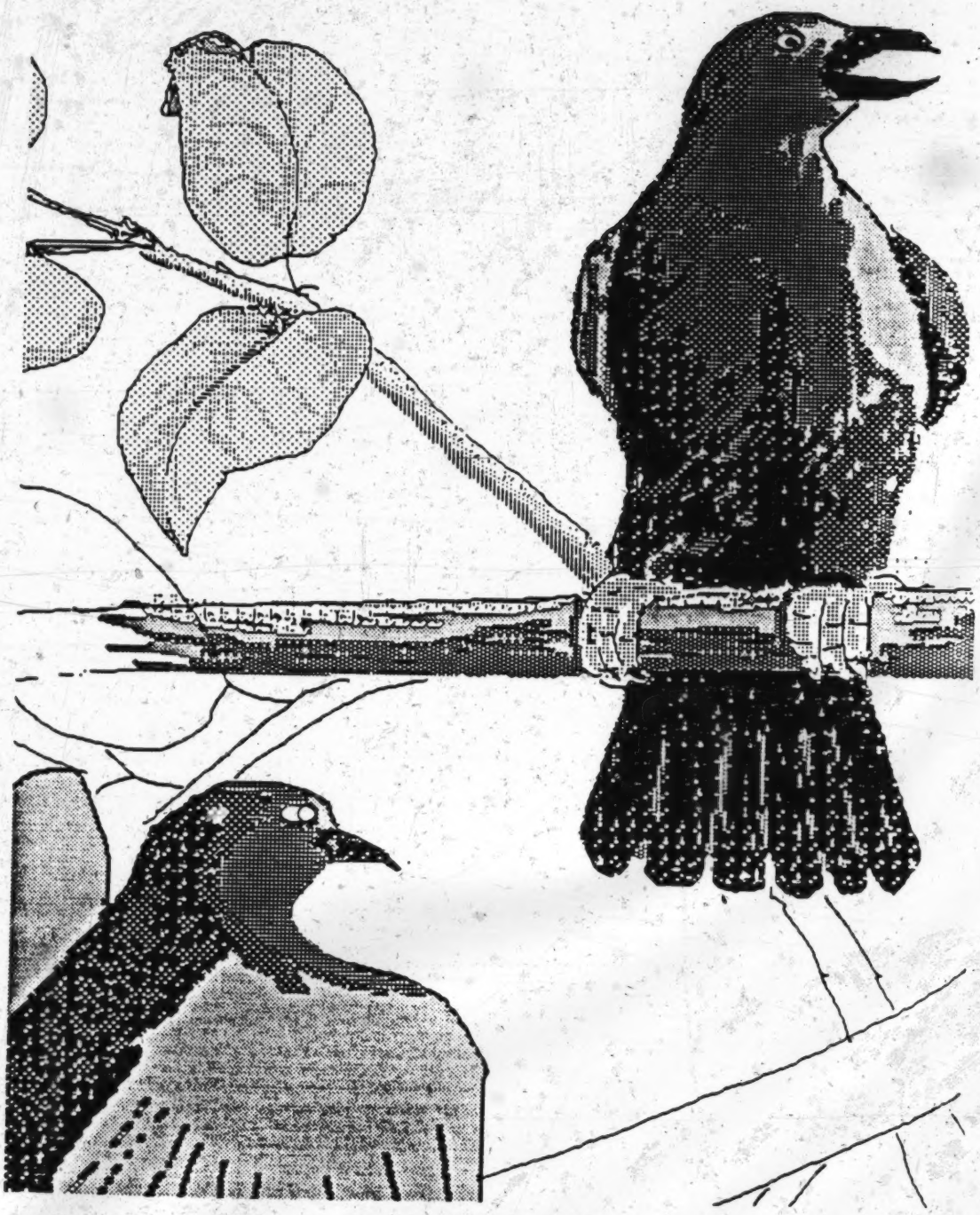


Fig. S36: Birds (Lana)

Fig. S37: Man's Face (Lana)

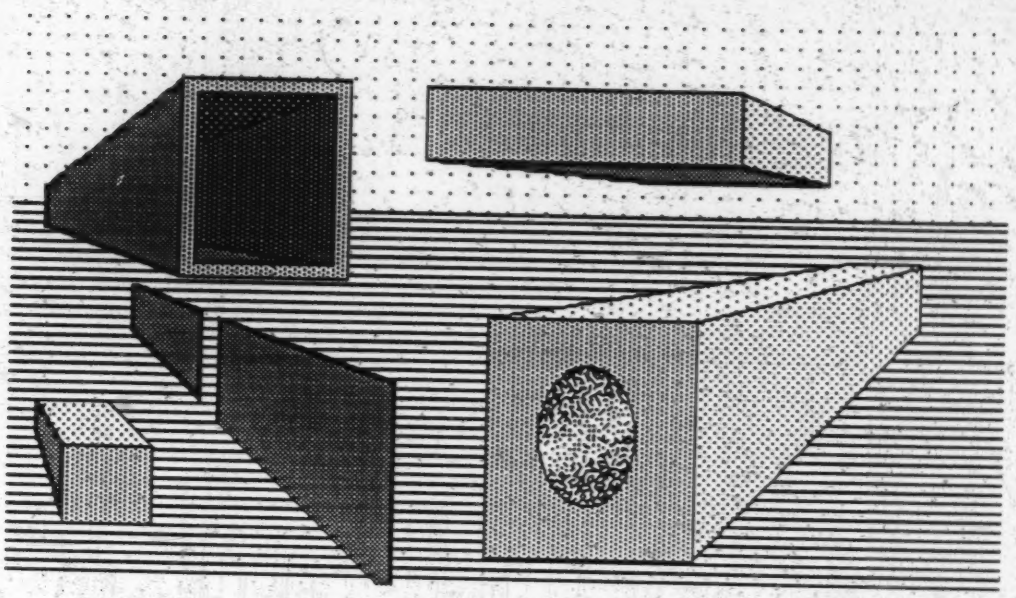


Fig. S38: Geometric Forms (Marilyn)

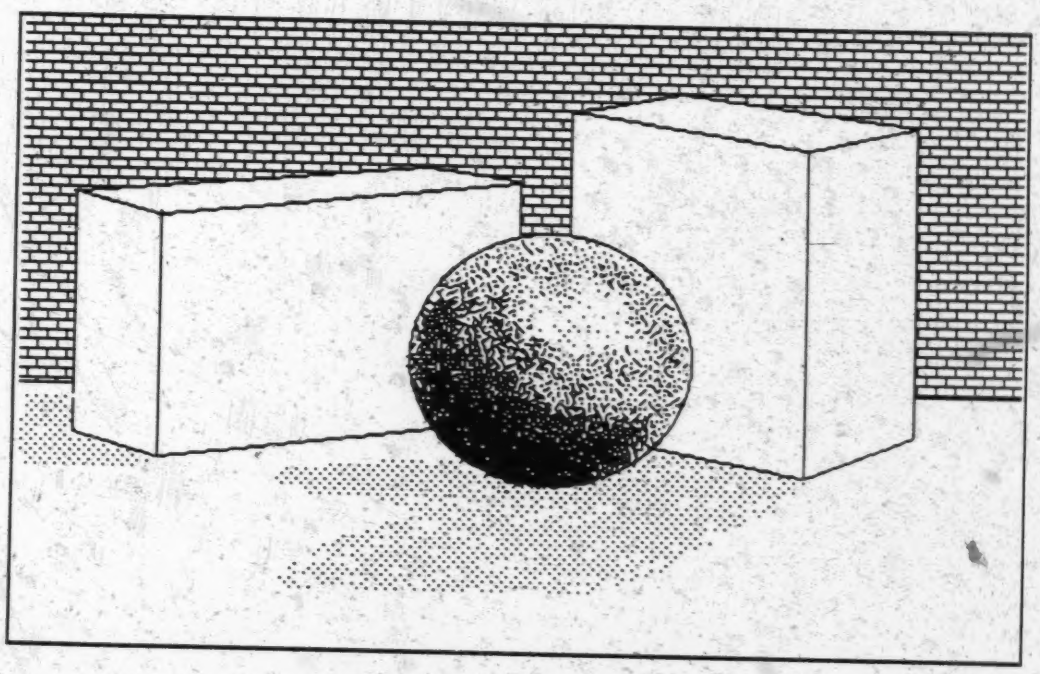


Fig. S39: Ball and Cubes (Marilyn)

Fig. S40: Palette (Marilyn)

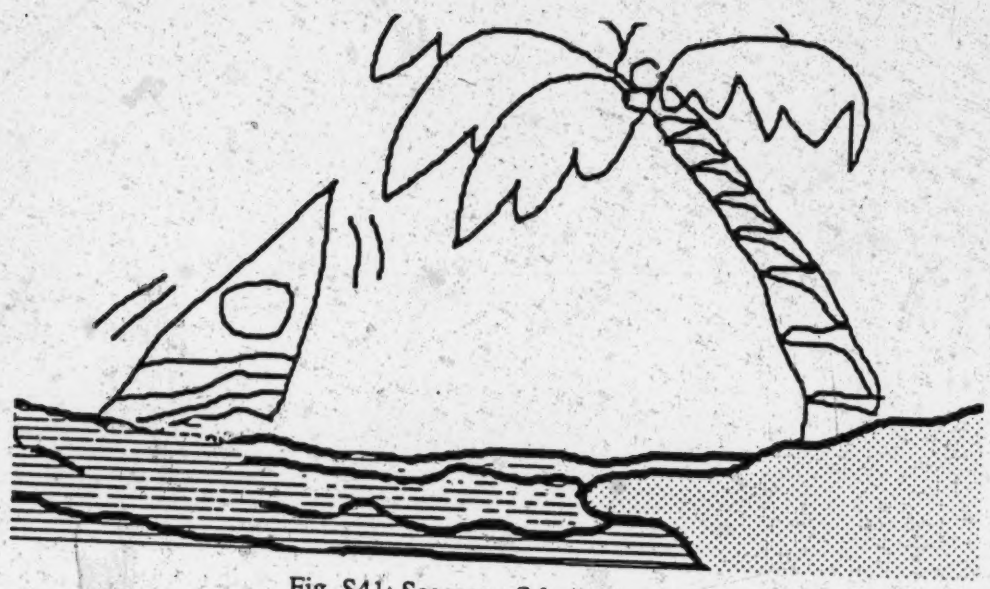


Fig. S41: Seascape (Marilyn)

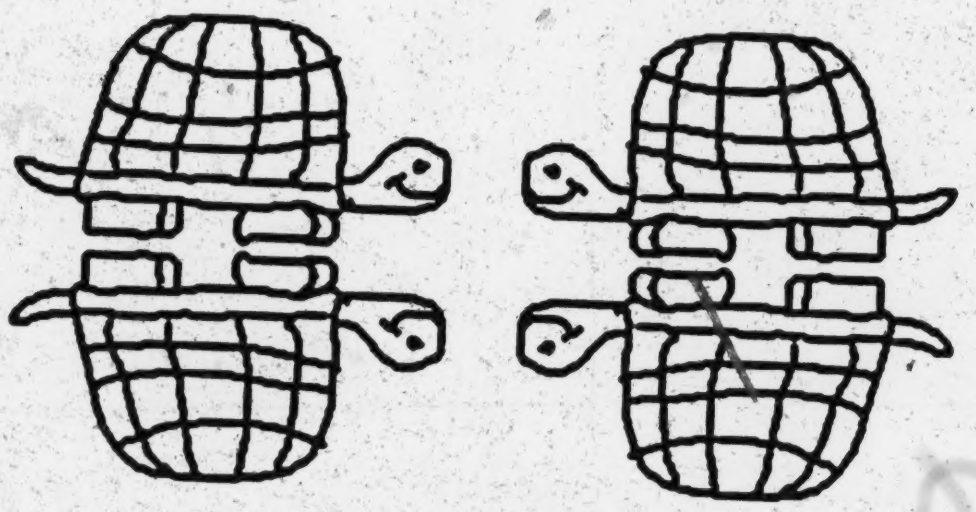


Fig. S42: Turtles (Marilyn)

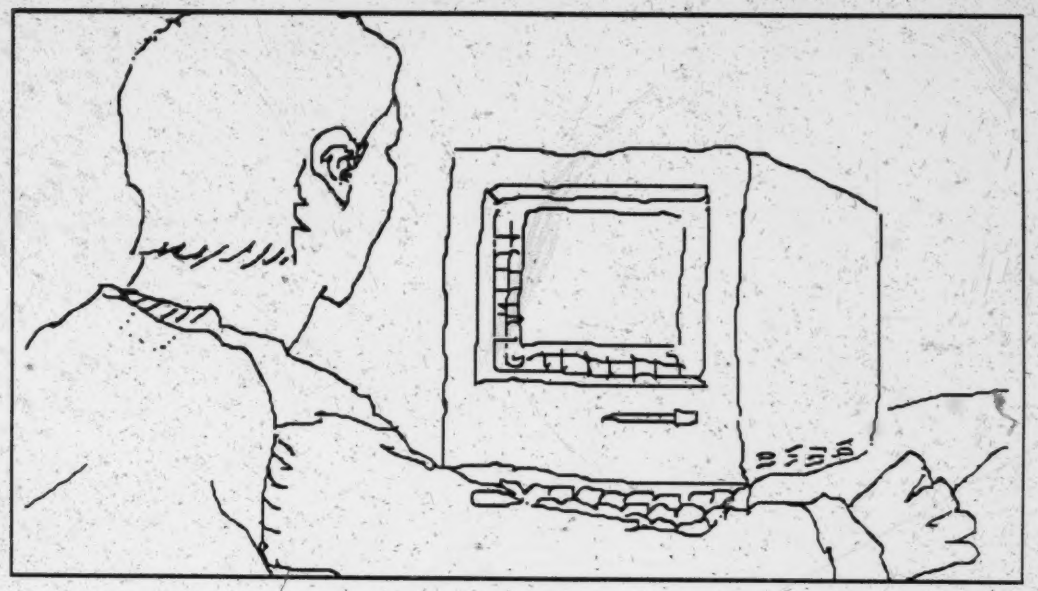


Fig. S43: Sketch (Marilyn)

Fig. S44: Dragon Sketch (Robert)

FigS45: White Dragon (Robert)

Fig. S46: Inverted Dragon (Robert)

Fig. S47: Face with Hat (Sheryl)

Fig. S48: Eyes (Sheryl)

Fig. S49: Evil Face (Sheryl)

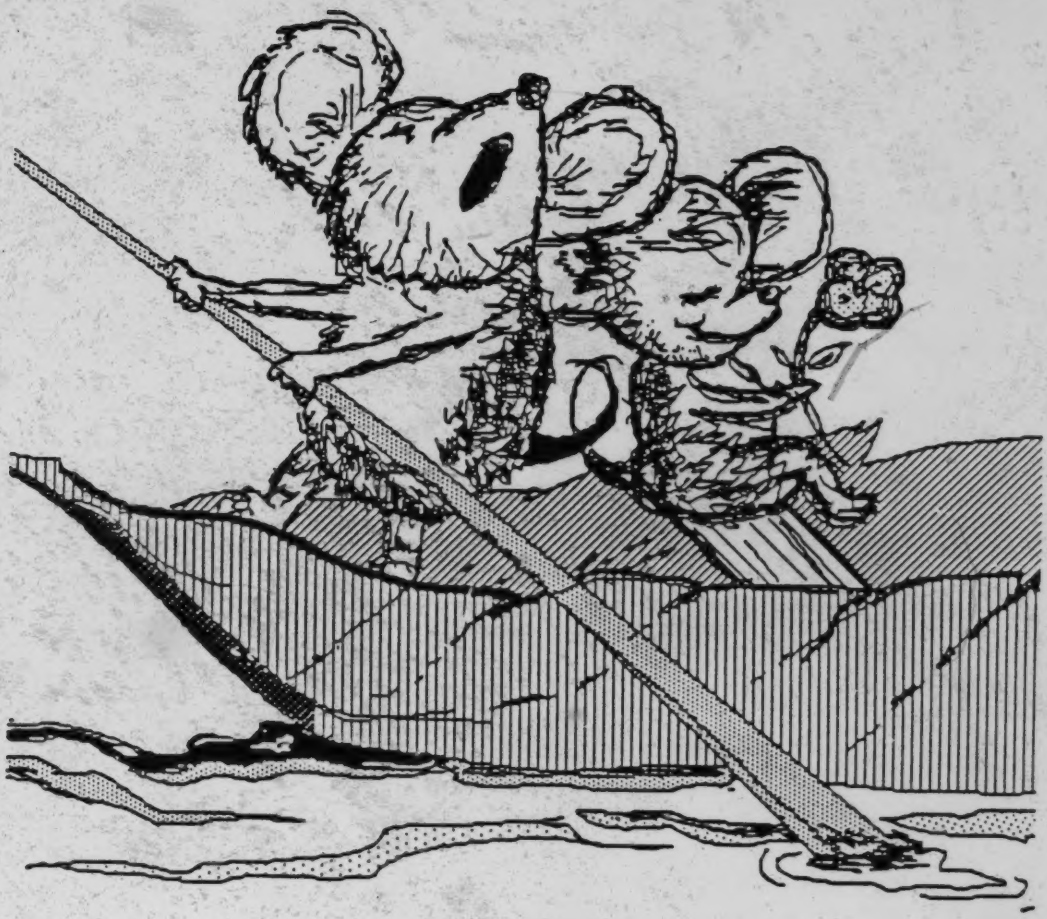


Fig. S50: Mice in a Boat (Sheryl)

Fig. S51: Portrait (Sheryl)

CHAPTER FIVE

Summary of Student Experiences

Introduction

To a great extent this whole student/computer experience has been a series of introductions to the computer and the program on the part of the elementary and secondary students. Distinct differences as well as similarities are evident between these two groups. And although there has been no overt attempt to elaborate on such group distinctions, it is, nevertheless, useful to here summarize each group in order to better understand the issues with which they were involved and also to attempt to glean from their experiences some sense of the meaning the use of computers had for their art.

Elementary Students

The elementary school students were absorbed with the computer throughout the sessions. The older students (Grade 6) tended to be less enthusiastic overall, often referring to the computer as a limiting device. This criticism was seldom voiced directly as a complaint, instead it was suggested in the search for ways around problems. When the two girls, Trina and Jody, were drawing the clown picture they found it too difficult to draw hands on the clown, deciding that it was easier to put mittens in place of hands and fingers. Decisions regarding such detail may have happened regardless of whether or not the computer was used but the difficulty of making small shapes with the mouse made it almost inevitable here. On another occasion, the two girls found themselves laughingly apologizing for their "terrible" handwriting that was made with the mouse.

Other students also found there was a great deal of difficulty in fine motor use being translated into an accurate rendering on the screen. Aaron had so much difficulty trying to draw a small dog next to his soldiers that in the end he didn't include one.

The younger students have tended to become extremely myopic in their visualization of

images. It was as if they often needed to understand what the computer is doing on a more fundamental level than their drawings could portray. Students like Greg would spend 15-20 minutes performing simple operations such as creating a line, and then tirelessly adjusting it. I could not help but feel this was very positive in the long run, that somehow Greg would develop a *feel* for the computer-line that he would later be able to apply. But it was frustrating to see him use so much time for what often appeared to be so little of consequence. He drew pictures on paper with ease, in typical Grade 1 style and with an appropriate attention to detail.

Greg did not always utilize his time in the pursuit of the details, but on many occasions he seemed dissatisfied with his efforts, going so far as to purposefully erase the screen before the Principal or myself could prompt him to save or print the results.

Jon's approach was similar to Greg's in many respects, despite his difference in personality. Jon was very keen on exploring a limited number of tools 'to death.' He would sometimes find an option such as creating a solid oval or circle and make dozens of shapes on the screen, each with the same pattern and in varying sizes, or at another time varying the patterns. These finished pictures had little value to him when compared to the intensity with which he occupied himself in their pursuit.

All of these students found the computer to be a very engrossing machine. The common thread running through each of the work periods was one of safe experimentation. Initially this experimental approach seemed to decline progressively with the increased age of the students, so that at one end Greg wanted only to discover all the possibilities of manipulating a single line, while at the other end the grade six girls wanted to be a little less experimental, concentrating instead upon their own task. In fact there were two different types of experimentation going on.

The younger students were inclined to try out all the possibilities of one tool, seeing how they could get control of this single device and not being overly concerned with what else was possible with other tools. In the two examples already stated (Greg's lines and

Jon's waffles) these children became totally absorbed in trying to exhaust the possibilities of that function, going as deeply as possible into what it could do.

The other type of experimentation was that of the breadth of the drawing program. The grade six girls were reluctant to stay with any tool that did not give them back satisfactory results in a relative short time. They did, on the other hand, try out as many other possible functions as they could in the time they allocated to the task.

There was also a distinct difference in the intent of the experimentation which took place. The younger students did not seem to perceive any purpose to their investigations other than to satisfy their own curiosity as to what the computer was about. The older students made a conscious attempt to make it serve their purposes as much as they were able, hence a lack of patience for a prolonged sense of experimentation in a narrow range.

Some drawings were accomplished with a minimum of planning, seemingly taking their direction from whatever program options were currently displayed. Examples include Jon's waffles, Greg's lines, Trina's illustration, or Matthew's scale, as each shares an extremely limited use of innovation, instead relying on geometric options that produce ready-made's not unlike stickers in various sizes and patterns.

Another picture, "This Maze is Flooded" was made by playing with the mirrors and afterwards attempting to fill in the defined areas. The task was so devoid of meaning that a game was devised to try and supplant meaning into the doodle-like drawings.

The question of whether or not a particular outcome was satisfactory or not to the students who made them, always seemed to bring interesting responses. Often if these younger students were asked if they wanted the effect that was just produced, they would answer in the affirmative, even if the result was a total loss of all they had done before. Older students were more demanding of the computer, expecting it to produce the types of visual effects which they desired. Younger students were as much interested in what might happen as what they wanted to happen. As a matter of fact younger students seemed to

demand the opportunity of allowing the unexpected (Jon's waffles) while the older students expressed consternation at just this phenomenon (Joseph's comments on luck).

Overall, many of the drawings seemed to indicate a proliferation of geometric shapes substituting for free forms, of patterns replacing ideas. There are some very natural and enjoyable drawings which seem to exist in spite of the wealth of technical possibilities contained within the computer program. Nevertheless, judging by the comments of the students, it is the drawings which contain the least number of *tool applications* that seem to be most rewarding to the them. There appears to be, at least in this limited sample, a trade-off between the artistic values of the work and the complexity of the machine. Drawings that were full in an information sense were not necessarily satisfying in a human sense.

Secondary Students

At the beginning of this class experimentation there was constant referral to all of the possibilities, the ideas that were easy to come by, and the apparent unlimited potential that was now available to them. At the same time it was clear that there was an attempt to try and fathom these *unlimitations*, to see where the specialness of the computer stopped and the drawings began. In other words, instead of now concentrating on their own art interests with a view to tapping the computer's potential for their realization, there was a tendency for the focus to shift to first seeing what the computer could do and then to applying this knowledge to their art. In such a case the result will inevitably be a lessening of the expressive needs in lieu of at least temporary fascination with the technology. Stating that the primary hindrance to the possibilities "is the operator's imagination" suggests that the artist is now an operator, and that there is in fact a need to look for possibilities as an operator. In this sense there is a similarity to the elementary student reaction.

Many students characterized the computer as giving them abilities they deemed important but were otherwise less attainable. These charactyeristics included the significant

increase in speed of execution, "The use of shortcuts: flipping, duplicating, or mirroring an image." Other comments stated: "It's quick and easy, and enables you to enlarge the picture for fine detail", and "all mistakes can be erased without the trace of eraser marks."

It was immediately apparent that the versatility of the drawing process was greatly enhanced by the use of the computer. These comments should be seen in a positive light as they were in response to a question which asked them to think of the "most enjoyable" aspects.

When the students were asked to state what they found most troublesome about the experience the replies were generally also of a technical nature. The ability to change the image quickly by choice simultaneously brought with it the possibility of quickly altering the image in non-desirable ways. A careless selection or mistaken command sequence usually resulted in totally unperceived actions taking over the process. This accidental erasing is different from the notion of *accident* in the sense that a new development might occur and this in turn spark new concepts in the mind of the art maker. In this more traditional approach it is understood that the accident is a new set of possibilities. Paint running down the canvas might be used to produce a particular effect, relying on chance in a controlled sense. There is no abandonment to external forces but a conscious effort to look for new possibilities. With the computer operating under menu options, it is possible to accidently invoke a procedure that is not necessarily related to the concept in progress. It's similar to picking up a paint brush and having the room door slam shut, or the light in the closet suddenly turn on. The interrelatedness of steps is not a function of the user as much as it is a function of programming.

Complaints from the Secondary students included difficulties/frustrations in:

- visualizing the entire page,
- making controlled curved lines,
- drawing on a small screen,
- not being able to move around the image (walk around the table),
- having to draw with the hand disconnected from the page,
- making improper selections from the icon list, invoking destructive instead of constructive commands,

- shading in gradual tones,
- the manipulation of the mouse.

There were other statements that looked beyond the purely physical encumbrances to begin to question the nature of the process. These included:

- a sense that the computer environment was sterile and impersonal, lacking the ability to respond sensually to the art makers gestures,
- a loss of the aura or style of the tools it purported to represent, painted lines were not painterly.

These complaints were repeated on a daily basis and it is therefore impossible to down-play their significance. The comments stated that there were three types of problems: physical, programming and affective.

Physical (hardware) problems that included a small screen, a clumsy mouse or drawing tool, the inherent restriction in physically accessing the image. The physical access of the drawing can be seen in ways. The drawing itself is inside a glass-faced box. It can never be touched since even a print is only a copy of what the image looked like at a given time. To make even a minute change it is necessary to get the drawing back on the computer, attempt the change and await (sometimes 2-3 minutes) the print.

The other type of hardware frustration is primarily stated as the requirement to draw 'off to one side' with the mouse while the image is directly in front. To say that the problem is only a matter of adjustment is to disregard the immediacy and intimacy of the drawing experience. It would seem to be similar to a person having to learn to use a prosthesis to hold a pencil.

There were program (software) problems that included questionable placement of the drawing tools (icons) so that accidental erasure might be accomplished when drawing was attempted. There was also an initial clumsiness in moving objects, and the irretrievability of steps (especially fill-ins) after clicking the mouse a second time.

Affective needs include the articulation of a concept or expression of a particular desire. The process through which this articulation is accomplished varies tremendously from individual to individual but seldom if ever is the computer mentioned as a means of en-

hancing personal expression. Art education does purport to offer this possibility, so it was an interesting question to ask students to compare their traditional approach to the new high tech means.

When students were asked to compare the use of the computer to that of paper and pencil, said one student, "The pencil is a finer medium. The mouse can't cover the whole page."

These are actually two significant but different types of observations. The pencil is unquestionably more suitable for fine work and can be very responsive to nuances in application. The mouse is restricted to a grid of 512 by 342 small squares (pixels). The movement of the mouse will cause the line to be drawn in short hops from one pixel to another. The screen can only support about half an 8.5 x 11 inch piece of paper and so can only allow the mouse to cover half a page at any given time.

In reference to the nature of the difficulties students found with the computer, one student stated, "The computer only lets me see part of the picture whereas with paper/pencil it is right in front of you, so you can see more clearly what you are drawing."

Again, this statement is accepted in two ways. First, the drawing in the computer was often spoken of as not there or not in front of them, while the paper was more concrete. Students tended to show frustration at not being able to just pick up the drawing and examine it, instead having to rely on what seemed to be an unwieldy magnifying glass.

The other sense of not being able to see the picture was a reference to the limitation of the computer to only show approximately 50% of the drawing at any one time. The rest could only be seen by moving the image behind the window (screen).

Most participants attempted to explain their experience in terms of the the more familiar art materials:

- the mouse is like a pencil, but more difficult to control,
- the computer restricts the presentation of the whole image,
- it's not possible to draw with the pencil or paint with the brushes the same as with the real thing (traditional materials).

One student was continuously stating her personal fear of not being able to do anything worthwhile on the computer. She stated on many occasions that she could work competently in traditional materials but that she was out of her element with computers. At no time was her attitude one of down-playing the significance of the work that was produced on the screen, but more of holding up such work as existing on a higher level than her own. She commented that the computer image was more "professional" looking suggesting the image said something to her about its integrity as an art work. Or it might be understood that the integrity of an art work is perceived in its completed state.

Another student had spoken of the computer as preventing direct access to the drawing; "Well when you have the pencil in your hand you are also looking at what your drawing. When using the computer you have to look at the screen alone."

This comment was very interesting because of the student's recognition of the value of coordinating the physical and intellectual effort towards a particular task, rather than working in a less natural manner which requires the artist to become a user or operator of a machine, separating the natural relationship of the hand movement from the resultant traced line.

There is also a complete absence of tactile feedback from the drawing surface, instead there existed a physical sense of the drawing mouse and the desk surface. This was from the physical sensations that were experienced from actual tools such as pencils and brushes. In the manipulation of different tools, there is first a sensation of the device itself and then a sense of how it contacts other surfaces. This extended or instrumental touching of materials would differ whenever the tool itself was selected as well as for differing textures upon which it was used to perform. With the mouse there was to be only one tool and only one unchanging surface to contact. Students found this worth mentioning in statements such as the following: "Like no matter what you use, a pencil, brush, whatever, it still turns out the same, a paper, a print. Like a painting has a rich texture, the paper doesn't."

And in terms of actually accessing the paper another student commented that she was bothered by, "Not being able to touch it. Not being able to hold it."

Screen size was also an area of discomfort.

> "For a large picture, you always have to stop and look at the whole screen - very time consuming. With a pencil you can create more versatile textures etc. One can sketch faster than using a mouse."

To look at "the whole screen" means to select 'full page' from the options and get a very reduced and very distorted image on the screen of what the whole page would look like. The only use for such a presentation is one of informing the user as to the location of the image on the printed page (centre, top, bottom, etc.) and the amount of space remaining.

> "Before filling in a picture you have to check all the sides (to be certain there are no gaps)."

Fill-ins are always a little trickier than anticipated; each line must completely enclose the area to be filled, any errors resulting in the fill-color bleeding into the adjoining area.

The following two comments are interesting to look at in combination.

> "When using a pencil, control is achieved by what pressure you apply for a dark/thick line or light/thin one (or loosely for a wiggly line or steady for a straight line). With the computer you have a mouse, not a sharp point."

> "The major difference is that with a pencil there is more exact choice of lines, and a computer has a wide variety of instruments that can work well together."

The first emphasizes the ease with which the pencil can be used, its outcome the translation of variable hand control. The second comment, from a different student, points out that the pencil is more restrictive in that one pencil has only one width lead while there are many possible line widths on the computer. This second comment must be taken as an exception to the general attitude of users as it doesn't address the ability of the user to effect variable line quality along a single line. Computer lines must be consistently changed so that any single line is similar in width along its entire length. There are also only a very limited number of possibilities in line definition.

What differences exist in the looks of the two types of pictures?

"The shade." "The lines are smoother in pencil."

This was understood as the paper/pencil provided a greater range of shading possibilities.

> "The computer can make pictures more precise, clean and crisp. The computer is able to erase mistakes completely where as if a pencil/eraser is used the picture does not look as clean/clear."

This precision is interpreted by students as both a negative and a positive attribute of the computer as demonstrated by the next comment.

> "A sketch on the computer is too precise and therefore it doesn't really look realistic. On a sketch with a pencil however you are able to make crucial flaws so that you have a much softer and a more realistic drawing."

Here flaws are understood as nuances of the human hand. The comment, "No feeling of warmth or tactility in computer graphics images. FLAT. LIFELESS," attacks the precision of the computer.

As with precision, the question of speed or expediency arises and tends to be understood in both positive and negative terms.

> "With paper and pencil compared to computer, the computer has a better look to it (the picture), more professional look to it, it looks clean with no mistakes (if you do things right). With a pencil/paper you can smudge it, not have lines perfectly straight, basically things looking messy and might even take longer than if you used the computer."

> "When using the computer you can get results more faster than pencil in the hand. And the computer could give you more better results than pencil in some points. Then it could be visa versa. For me the results would be better if I were to draw it on paper with pencil in my hand, me and the computer don't get along to well. "

Another question had to do with the differences the students noted in subject manner, and whether the use of the computer caused them to draw things differently than they normally would? Answered one student, "Perspective works well, as well as man-made objects, however nature's soft outline makes it difficult."

There was a recognized type of drawing need that was met with the computer. Drawings requiring precise lines, perspective layouts, etc. were often considered as suitable.

> "It causes me to draw things more sloppier because I know I'll be able to go back to it later and correct it."

This comment was one of the few that suggested that the whole approach to drawing was potentially altered by this experience. That the computer tended to incline the user to "become sloppier" was most certainly a less than desirable aspect, another student saw this as an inclination to become more experimental.

CHAPTER SIX

Findings of the Study

Introduction

The primary objective of this study was to ask what students perceived as to the value of the art experience with the introduction of computer technology. This main question was responded to by asking:

1. How does computer use affect the child/art relationship?
2. What issues and concerns are created for art educators as a result of this relationship?

The first question inquires as to the relationship that is established between the child and their art through the computer as mediator. The second question asks of the relevance of these findings, in a sense it asks of the implications for art educators.

Chapter Five presented a summation of the experiences of the students. These reflected a number of issues that seemed to recur widely within each group (elementary and secondary). In order to assess what is significant about these issues, they have been grouped in the following order:

- Content - what the pictures contained in terms of form and pictorial content,
- Emphasis - stated and observed priorities. Whether an emphasis was placed on visual content, concept, or experimentation,
- Enjoyment - of the work as well as the working environment,
- Rationale - justifications for computer use and perceived understanding of their role in the art experience,
- Simulation - the tendency to understand the art experience with computers as other than real life experience,
- Tools/Techniques - the reference to, and attempts at, allocating the computer to the role of tool.

Content of Pictures

The highly geometric, patterned content of many of the pictures shows clearly a tendency on the part of students to shift their work to take advantage of the built-in features of the drawing. Initially at least, this seems inevitable. After all this is the only means whereby any assessment can be made as to what qualities the program offers, and if these are desirable or not.

Elementary students pictures were usually either primarily geometric (lots of programmed features) with little or no free drawing, or else were primarily free drawn with little or no geometric forms added. The other choice which tended to be followed by older students would be a free mixture of individually controlled lines with computer-assisted additions. Freely drawn lines were usually the result of the student having a concept which they did not want to lose in the myriad of possible expressions, whereas geometric forms usually represented an effort that was directed towards revealing what it was the computer could accomplish. Seldom did a student have the approach to the computer that he or she might have towards a simple tool, that is, the ability to use it selectively.

A selective functioning of the computer's programming is a conscious act that is more easily achieved over time, when an understanding of its potential application is more apparent. Such use implies a placement of importance upon the concept so that the computer's features are selected as appropriate. When the younger students did select programmed functions it usually meant it would be employed for everything. The concept, for these student drawings, seems to be the method as much as any idea or conceptual intent.

The majority of all pictures seems to be comprised of limited groupings of objects afloat in a sea of patterns. This is evidence of a natural inclination to use the fill routine to complete a picture. Exceptions to this tendency appear to be in direct relation to the strength of the original idea. Examples can be seen in Carl's Yacht, Helen's Portrait, some

of Margaret's and most of Joseph's pictures. Each were realized with minimum purely decorative fill-ins, each is visually strong.

Usually the unclear idea or the exploratory approach of students inclined them to check out the fill can and give a spray of something or other to the background. In this sense it does not seem unreasonable to regard some of these uses as simply graffiti, striking a little personal identity on a stark computer wall.

There were some very strong drawings that resulted from the use of the computer. Yet subject matter seems of little overall importance in most pictures. In fact the use of the mirror and duplication capabilities sometimes rendered the subject matter to near insignificance. A landscape which was changed 8-10 times became a repetitive example of computer virtuosity and a statement of a student's lack of expressive desire.

Ready-made's is a term that came out of the sixties when artists like Rauschenberg, Warhol, and Johns selected items for inclusion as art items. This approach to art got its earlier beginning from Marcel Duchamp in the 1913 Armory Show at which time Duchamp stated that the designation of an object as an art work was sufficient to make it an art work. I use the term in this study to refer to the built-in (programmed) options such as the circle tool, which allows a student to designate functions for inclusion without the necessity of having to construct them. There is a great deal of student work which is comprised of ready-made's in content.

Content or Concept as Priority

For the older student the emphasis is most certainly placed upon the final product, not the process of creating the work. Often the process is regarded as necessary but frustrating. These students were very vocal about their dissatisfaction regarding the encumbrances the computer has placed in their way, often requiring them to alter their intentions in consideration of the material they are working on.

Elementary students often wanted to deal with the mechanics, enjoying the experience of discovering the computer. They were not at all concerned with what it represented or what it implied about the nature of their work. It seems quite safe to go as far as to say they could not differentiate between what they wanted and what the computer allowed them to accomplish. They entered into an experience with the computer, its allowances and their skill levels all aspects of this same experience. The older students attempted to create the experience and its success or failure was indicated by the visual outcome of their work.

The emphasis on the content of the picture suggests that the student has decided to develop a fairly specific direction and then to use the computer to fulfill this intention. In this sense it is not loose experimentation that becomes the driving force, rather it is an attempt at controlled interpretation of a concept via the computer. This approach is one of the reasons why the elementary students were consistently enthusiastic about the use of the computer, the secondary students consistently dubious. The older students tended to try to make the situation mirror their traditional approach, the younger students tried to find meaning in the exercise itself.

Experimentation as Priority

Most art educators, in contemplation of a student learning to draw, would have little difficulty envisioning the scenario of a little boy scribbling on the screen and eventually raising his scribbles to a state of art work that somehow justified the hours put into the machine. Experimentation is the standard conception of a child becoming acquainted with a new material, exploring its possibilities and then eventually settling down to utilize it in some self-expressive manner. Some degree of gratification may be achieved in this approach but the realization of the potential of the computer is not to be found by binding it to contemporary applications. Experimentation in those terms is an exploration of the limitations of a tool.

Enjoyment

The enjoyment of the time spent working with the computer was clearly the strongest with the younger students and fell off quickly with an increase in age and grade. In fact observation alone, of all students, would confirm that a large part of the time spent was very much unenjoyable after the initial day or two. Class interaction was minimal or non-existent in the senior group, while students were either isolated completely in the younger group (machine protection) or else were working in pairs.

These observations were substantiated by the comments of students who spoke of the lack of a social atmosphere, of separation from other students, as well as from the art work itself. In fact there was a consistent tone of resentment among some students in regard to the forced atmosphere. It should be noted that the senior students were using a structured computer lab environment, but no restrictions were placed upon their movements in or out of the classroom, their contact with others, or the content of their productivity. It was the nature of dealing with their art work inside a closed capsule that enforced its own one-on-one and defeated any communal exchange of ideas.

Comments regarding finished work, if they took place at all, usually occurred in front of the computer so that its image could be seen on the screen, not at the laser printer or with the print. When the print was shown as being successful, by a student to others, often they both would then go to the computer to verify that it was actually there or to see what it actually looked like. This is important in that the print was not seen as the result of the work as much as the screen image. This 'real thing' was mysterious in that it didn't actually exist anywhere in completed form. It was in segments on the small screen or in representational form on paper.

Rationale

In A Strategic Planning Symposium (Moursund, 1986) two specific questions were posed to try and identify directions for educators. These questions are straight-forward and

contain a search for intentionality on the part of those who must establish a working rationale for computer use.

- What are we trying to achieve?
- What do we do to initiate and maintain teacher interest in computers? (p.38)

Such concerns are equally a part of the rationale of students, albeit their rationale is more egocentric. Secondary students spoke of attempting to justify computer use in art as preparatory for some yet unknown career association in the future. This justification is typical of the approach of senior students in attempting to use their school experience as a launching area for future successes. At the same time there has been little time to date to suggest that either such computer preparation is valuable in the long run, or that such a rationale is justifiable as the basis for art utilization of these computers.

Simulation

A sense of perceived unrealness pervades the descriptions of the senior high students who speak of the lack of physical contact they have with the image. As far as the secondary students were concerned, the drawings weren't real. They were substitutions, imitations. For the younger child the work itself, the activity, was real because the reality was in the doing, seeing what special effects there were hidden away in the computer. For the older student the doing was seen as a necessity to achieve something that responded to them emotionally.

Senior art students found a high degree of similarity in the work which came from the computer. They expressed concern that their own style was difficult to develop, each picture having a little of someone else's look to it. This "sameness" already mentioned by so many students seems to suggest a sameness with the work of other people, but not a similarity to that type of work which the student feels personally comfortable with. In other words, the sense of 'other' is more apparent in the feel of the work than that of 'self.'

This can be accounted for in the use of a common body of techniques, which tended to filter out some edge of uniqueness the pictures might otherwise contain.

The newness of the computer creates a great deal of uncertainty, hence the makers attempt to give it a place by simulating actual materials and processes. The end result is simulated activity and imitated products. Treating the computer with more respect for the technical marvel that it is requires asking what it is that is unique about it, and in what manner can it be functionalized so that it transcends the synthetic position it presently holds and instead becomes beneficial in its own right.

The best means of utilizing the computer might not be in simulating more but, instead, using it to create more. Instead of digging deeper it might be more profitable to dig elsewhere. Where possible programming may be a viable avenue but there are others.

Tools/Techniques

As the students increased in age, they discovered there was less and less they really controlled in the program. Since the younger students were largely concerned with understanding the ripples the computer could produce they were consequently keen to risk "spoiling" their work by overdoing fill-ins and patterns. It is easy to accept this as simply a lack of artistic or personal discipline, but it was largely displayed as a conscious effort to keep the activity going as long as possible since once the action died down the art work was dramatically devalued except as a spark of its previous self.

When Jon and most of the other elementary students were asked to make decisions regarding what tools they should next use they would often view the problem as a technical one. They were not easily able to discern why one approach might be preferred over another. The shift in focus from the active to the passive role in the art making process seemed to be a requirement imposed by the Principal/teacher. When he was not there, there was a great deal of excitement about trying out some new possibilities.

One of the issues needing long-term clarification is the possible definition of the computer as an art tool. If the computer is nothing more than a tool than it may be treated as all tools and relegated to the needs of the art maker. On the other hand if it is more than a tool then asking what it is, is certainly a prerequisite to any research into its implications. The possibility may exist that it is some type of all-encompassing super-tool which has the potential to be used simultaneously as a number of other tools. The question is neither trivial nor solely semantic. If art educators use the computer as just another tool for obtaining special effects they potentially restrict the use of this technology to accomplish only at the understood present limits of other more traditional means. But even more importantly they may socialize art students to a particular understanding of themselves as part of the input devices which cater to the computer and its programmers.

Art students are encountering computers at a rapidly growing rate, and not only is the frequency of this interaction likely to pose some necessary questions, but the changing nature of the technology itself will require its users to define some degree of understanding that is not based upon a particular set of circumstances but an appreciation of the nature of computerized graphics.

If computers were just new tools there would be no need to further question their role, but computers are more than just tools and even more than machines. They are, at the very least, systems.

One of the reasons why the computer cannot be regarded as a tool is that it cannot be first explored for its limitations before applications are made. Tools can. An example of the difference between tool and system use can be shown with the example of the brush "tool." Brushes are identified by their mark, as if looking at them from under a piece of glass, or looking at a glass wall with a painter on the other side. Viewing the tool this way is interesting in that the outcome of the process of painting is presented prior to the action. Brushstrokes are picked from a menu with the resultant image awaiting attention. With a tool the task still remains to invoke use and establish an effect upon the material. With a

system the effect is already established. What remains is to place it, as completed, upon the surface of the material.

In fact, the computer itself created this question. The hand, in using a tool, was still in physical union with the art piece, i.e. the spatial relationships between the hand gesture and the resulting effect upon the art piece were consistent and fairly predictable. When a brush, pencil, or carving tool were moved in a particular fashion the distance and depth of the movement was reflected on the surface of the art piece. With the computer this corresponding reaction can be programmed to be equal to or different than the original movement.

Conclusion of Chapter Six

Given the stated differences and similarities between the use of the computer and traditional materials, the question arises as to what significance it is for art educators to recognize the special nature of the art/computer experience.

The next chapter presents the conclusions of this study and some reasons why it is important to become better prepared to accommodate computer technology into the classroom.

CHAPTER SEVEN

> Today man is mainly educated in pseudo-analytic thinking, and his knowledge consists of so-called "facts". His life, however, is becoming ever more meaningless, and ever more he understands that his "merits" do not count if he is not able to "dwell poetically". "Education through art" is therefore more needed than ever before, and the work of art which above all ought to serve as the basis for our education, is the place which gives us our identity. Only when understanding our place, may we be able to participate creatively, and contribute to its history. (Norberg-Schulz, 1980:202).

CONCLUSIONS

At the completion of this study one major question emerges. Given the phenomenal success of video and computer assisted graphics that are presently exploding throughout the general computer world, why then did these students conclude a less than enthusiastic characterization of their art/computer experience?

The answer to this question helps point out some of the naivete that surrounds the issues. Definitions of art, of the impact of computers, and of success, are all potentially frustrating areas to explore, and there is little to indicate that answers will lie at the end of any such exploration. Suffice it to say that all art is not necessarily valuable art, and that any computer use does not necessarily represent all concepts of computers. Because these students were using art class time to experiment on the computer, and because they believed that this time spent was less than totally successful in their estimations, is not sufficient grounds to state that computers are not suitable for the expression of art.

In Chapter Two several statements have been reported from various artists which cast a very positive light on technology in terms of art applications. There is more than simple speculation to suggest that computer technology is indeed very much suited to certain artistic expressions and that a failure to have this circumstance realized may be primarily a criticism of the specifics of that student/computer interaction.

What happened in this investigation was very typical of what many students would encounter in their own school art programs (if not more fortunate here due to the high

number of advanced machines) if they were offered the opportunity to use computers. The majority of art teachers are not computer literate (here meaning that they are not experienced in various software packages and hardware configurations, let alone programming skills), they are not necessarily sympathetic to computers, and they are certainly not likely to have ready access to computer usage. It can be reasonably stated that students would often encounter this experience with minimal preparation, except in more traditional art materials, and would therefore have to develop their own directions using already existing software packages.

More instruction on the use of computers was then not needed for two reasons. First, the Macintosh computer is so straightforward in its use that there was no need to spend more time with instruction. Second, the question for the study was to uncover the perceptions these serious and motivated art students had to the use of new, but manageable technology. These Art 30 students lacked neither the abilities nor the incentives to produce work. Their critical responses were not ones of avoidance but assessments of a circumstance that seemed to contradict their prior art experience.

The first section of Chapter Two, "Technology and Art Education," pointed out the role of technique within Art Education, showing that there is a dependency upon technique as a vehicle of instruction. Art educators are easily inclined to regard the advanced state of hardware and software packages as an extension of this approach, it already representing a set of *how-to's* which will ostensibly allow the student to transfer prior art knowledge to take advantage of this "new tool."

There are several conclusions which have been reached as a result of this study. They are listed below in a non-hierarchical numbering format, with the primary intent being one of readability.

1. The Place of the Computer in an Art Setting

The role of the computer as a tool is not a given. Computers cannot be simply slipped into existing art programs since they represent more than a change of tool. The description of the computer as tool requires the user/teacher to see the computer environment as limited, understood, and controlled. It may be none of these. Consequently, treating it as such would also be accepting as a given the programmed techniques and the controls that result from their use. Conceivablly the initiation of such dormant techniques may actually be in conflict with that process which is required by the user.

The difficulties students encountered cannot be attributed exclusively to software selection, since there are a variety of packages available but all operate within the same structure. Having noted this point, nevertheless it was the programmed aspect of software that was often seen by students as a constant restriction to complete freedom. In this sense software must be understood as inextricably tied to hardware, the program cannot function external to the machine. Hardware restrictions tended to be as constant a problem as the software, though was mentioned directly in varying degrees. Screen size, restrictive access to image, and an unwieldly input device were all mentioned with great frequency.

It is the process of actually attempting to draw on the computer which seems most questionable. If freedom equivalent to that found with traditional materials in sought, then why use the machine at all? If these same traditional effects are desired then it is possible to transfer paper drawings into the computer via digitizing equipment. Pictures can be scanned and the image moved into programs like MacPaint, etc. allowing them to be acted upon in the same manner in which they would be if drawn within the program. The result is a bit of a trade-off, there is a transformation of the picture into a flat, high-contrast image. Newer computers and programs provide for less contrast and the use of color. Nevertheless, there is the recurring democratization of all aspects of the image so that heavily accentuated lines are somewhat reduced while otherwise insignificant lines are strengthened. This democratization results from the same phenomenon that photographer's

find in high-contrast film work. Lines are either displayed strongly or not at all. The results of these effect on children's art in the computer cause questions to be asked of both the suitability and efficacy of the procedure.

2. Student Differences

Differing ages of the students resulted in different expectations and levels of satisfaction. Younger students tended to make this experience meaningful by becoming involved in the making process and letting themselves be guided by a sense of adventure and exploration. Older students tried to control the experience, to make the computer behave much like the traditional art materials. This led to frustration on the part of the secondary students and seemed to be in conflict with their expressive wants. In fact the tendency to attempt to achieve technical dominance was the single most noticeable trend in the senior experience.

Student expectations also varied quit a bit from student to student. Some sought to openly explore the computer in as much of an unbiased manner as could be expected. There were others who were already suspicious of the technology, and only wanted to find evidence of its inappropriateness to the situation. Still others hoped to make the best of the circumstances whereby they would be engaged in a trial with what they felt were new tools. Such diversity can be expected from any class and is certainly typical of the range of students who are found in the school generally. Of course these expectations will play a part in the ultimate success of the experience and therefore need to be recognized.

3. Technical Priorities

An emphasis on the technical seems to result from the presence of the computer itself, since it exists as a result of programmed thought. Within the school environment, and without guidance, students are not likely to come to terms with the computer very quickly. Whereas it may be entirely different if the students had completely free exploratory time

with the computer, the fact remains that computer time is regarded as privileged and, certainly, controlled time. If the nature of this control is to promote assignments that conflict with the fundamental premise that the computer is not a tool, then a great deal of frustration will result. If on the other hand, the assignments are appreciative of the computer as system then outcomes may be possible which are both meaningful and enjoyable.

The placement of students into a computer environment (Principal's office for the elementary and a Micro-lab for the secondary students) rather than placing the computer into a student environment results from the premise that what needs protecting here is the machine, and the student is one of the hazards that it needs protecting from.

As stated in Chapter Five, the whole experience has been a series of introductions to the computer and the MacPaint program, and there is no indication that this approach would alter over time. The constant change in technology and with software packages ensures that there are always better ways to accomplish what had earlier taken more time, or more work. The focus on the drive to always invoke these better methods becomes a driving force of its own, dictating emphasis on the improvement of the art process.

What it means to improve art becomes an issue that is a direct consequence of using the computer. Art improvement was not even a widespread concept in prior times since the emphasis was, at least ostensibly, focused on the art maker's concept, not mechanical production. Donald Verene (1984), in reference to Ellul's understanding of technology, asked the following questions: "How can this be improved?" and "What other things might be subject to such procedure?" These are questions of improvement and application. It seems to have a direct bearing here on the use of technology to improve art. But what is being improved? The experience? Not likely. The art work itself? Most assuredly. And the only plausible manner in which to accomplish this is in terms of its production. It seems less than inevitable that the human experience is to be considered an essential component in this manufacturing process.

From where do students get the belief that the straight line is the better, more "professional" approach? To what extent is the mechanically endowed value system the standard against which to measure their own competence? Then again, should this response be a surprise when it reflects the textbook standards that these students were raised on?

Joseph Weizenbaum (1976:16) cautioned that, "We can count, but we are rapidly forgetting how to say what is worth counting and why." It seems applicable to state that we can also manipulate images, but we may be forgetting how to say what is worth creating and why.

4. Social-personal Issues

Enjoyment of the computer-assisted art class takes on a different meaning than in the traditional class. Socializing that was usually coincident with the art class has been replaced by a forced myopia of concerns, each student confined to a different vision of what work is to be accomplished in a class. The situation was similar to a group who normally share in watching a football game now being placed in separate cubicles with their own screens and different aspects of different games being viewed on each silent screen. A lack of cohesive sharing of the experience was noted by several students as well as by the researcher, and in fact it appeared at times that even the most casual of contacts were suddenly unwelcome. There was always the risk of inadvertently selecting a destructive or altering command. Concentration was not always the result of interest, sometimes it was an imposition.

5. Student Perceptions

Another manner in which the computer altered the experience, and possibly one of the more significant, was in terms of how it inclined students to view their work. Elementary student's drawings on the computer were easily discarded, from both a physical as well as a psychological meaning. Lines that were purely decorative, along with those of a more

expressive intent, gave no visual indication of which was which. Fine articulation, pressure on the line, and variable width, were now all taken over and smoothed out. In fact there was a complete democratization of all lines (visual data) so that each was appearing to have equal merit on the screen. This effect resulted in slight touches to the mouse being translated into dark distinct lines that fought for legitimacy among the intentional lines. All lines were all suddenly important since they shared equal visual distinction on the screen.

Such democratization of everything said that everything was important, which is another way of saying that nothing was important. If there are no distinctions of importance, then there can be no hierarchy of importance. Getting rid of one line or one image is no more difficult than any other and the computer reinforces this point by completely obliterating any image it is told to, without regard. If the selection was erroneous and no steps were taken to preserve backups the removal was permanent.

This occurrence created consternation for students who attempted to make their work the uppermost issue in their mind. Unless they allowed the computer to be considered as a potential threat they would not save their work sufficiently or they would instinctively perform some computer operation that conflicted with their actual intentions.Students were required, like it or not, to constantly bring the computer from a background position into the foreground of their thinking, to prevent it from becoming transparent.

6. Simulation

Humans understand the present in terms of the past. Photography was considered a threat to painting when it first became popular. Over time photographic technology developed its own directions and allowed for a form of expression like none that had occurred before. So too can present graphic high technology only be understood in terms that preceded it. It is inescapable that the tools of the artist will be mimicked to make the computer responsive before a new repertoire can be devised.

The computer offers the means to allow for a less tangible or a more synthetic existence. Simulated flying, games, etc. which require no personal risk respond instead to intellectual rewards. The separation of mind and body involvement within the arts establishes a simulated art activity, since it is by virtue of the absence of the physical being that simulation is defined.

In the discussion of the manner in which a computer could duplicate or simulate art one student said, "The computer can't think about what's going on around it." This seemed to be an insightful, if obvious, statement showing just what the limitations of the computer really are; given all the techniques, the computer has no realization, nothing to say. Yet the computer is often given a pseudo-independence so that it is referred to as another being. Students marvel at its skills and then sometimes compete with its powers. At the same time they make attempts at confining it to the rank of a tool, and then act irritated that it doesn't behave like one. The capability exists to have this system produce very impressive outputs that resemble humanly constructed art pieces.

The reference to the computer as another being is so common that it hardly needs pointing out. Yet, it is precisely this ease in referring to the machine in an objective sense that forces one to ask if the techniques embodied within it are intuited so clearly that a sense of 'presence' is acknowledged? Is this "personal" association a heightening of the other's (programmed) techniques? Would their use suggest the computer offers a chance to utilize the techniques of another person, no longer restricted to personal limitations?

Attempting to draw almost like a real hand might draw seems to have little merit in research - the hand already accomplishes that rather well. Mimicking artistic experience in the name of art, instead of extending it, abuses the spirit of humankind. Using the computer to extend the human touch with greater sensitivity is a possibility that still waits to be addressed.

In the end we must recognize that not only are the instruments (simulated) similar to each other and lacking any true identity, they are in fact, nonexistent. The illusion is so

complete as to obscure that reality to the point that students tried to paint with the brush and draw with the pencils.

Imitation of *activity*, and imitation *of the work of art* present themselves as two dangers of computer use. If the computer is to be utilized by the students it must be relegated to the role of tool, it will not in and of itself settle there. The computer cannot be approached on the old terms since it doesn't fit the definition. Just as television can be functionalized so too can the computer.

7. Pedagogical Efficacy

Art is the ongoing process of the action and interaction of the maker and the piece. The ongoing nature of art is possible with computers but not every file that results from the use of a drawing type program becomes an art piece. The message these students give is that much of what they accomplished is questionable as either experience or art piece. The situation is similar to using an elementary teacher's mimeograph book which provides ready-made outline drawings into which students are encouraged to be creative and fill in the pictures with different colors. The circumstance has long been regarded as a virtually meaningless time-filler, since as long as students are responding to preset parameters on their own images, they are being manipulated, and somewhat violently in this example. The computer users have more freedom in terms of their image selection but are still very much directed along certain lines. And the programmer is not the only dictator of possibilities. It may be the expectations of students and their teachers that in turn is exemplified from greater social pressures which is most compelling. Such expectations may in fact become hidden directives.

On the other hand the computer's strengths seem to lie in innovation and creativity and in offering the opportunity to ask new questions, not in trying to duplicate old answers. Artists like John Cage gave new answers, but were clearly just tapping the surface of an emerging technology.

Dale Peterson, in Genesis II, writes:

> Life is the immediate sequence of events and actions in the material universe. Art is a mirror or lens acting upon that immediate sequence to produce an image or model or enduring impression. Art, as mirror, can reflect life with realistic accuracy. As lens, it can *refract* life in surprising, interpretative, non-realistic ways (emphasis in original) (Peterson, 1983:157).

Simulating life does not pose the problem. Such is the mainstay of art. It is the process of simulating art that poses undue difficulties. Whether or not the computer is a tool is not the question. At question is whether it is being used as one, and what danger is present when it is used in place of actual experience. Simply using it in an art class is not sufficient verification for artistic expression. The computer experience is not drawing, and it is not painting, and it is not weaving or sculpting. In trying to impersonate these other activities, it is also not whatever it is that computers may become.

IMPLICATIONS:

New Issues in Art Education

This study was conducted to research the question of the manner in which computer use effects the relationship that a child has with art making. As stated in the preceding conclusions, the introduction of microcomputers into the art environment is not equivalent to simply acquiring the use of a new tool. Computer use provides possibilities and likewise makes demands. The nature of these demands is of vital concern to art educators as they will bring about a questioning of what traditional values should be necessarily retained. Furthermore, the use of this technology will force a retrospective look at what basis there was for the inclusion or acceptance of these values in the first place. If processes that were always conducted in an established and traditional manner are suddenly made accessible in new ways, there will inevitably result a look backward at the roots of the process to ask what it was that it was meant to produce, and what might now be in

jeopardy. Such questioning can only be positive in the long run, clarifying the premise upon which class activities were based. This may be the least noticed effect of computer utilization. It may also be one of the more significant.

Art Educators may draw several implications from the preceding conclusions in regard to teacher education, issues of pedagogy specific to Art Education, student comprehension and responsiveness, and computer familiarization.

1. Teacher Education

Art Teachers need to understand the special role technology plays in their field, as well as the uniqueness of the computer. Generally, Art Education is existent as a structured environment which encourages student growth through the development of specific skills. Whereas this is an essential component of the art class it is important to comprehend art education as more than simply the instruction of techniques, a circumstance that is well understood and addressed by art teacher education institutions. But the computer can make this more difficult since an unquestioning approach to its use can be an acceptance of technological imperatives. In other words, students may be encouraged to put the focus squarely on impressive programming for marks, whether or not the episode is valuable to them for other reasons. The computer can be utilized but not relied on. To offset this risk more appropiate education, awareness and encouragement is needed.

The students in this study produced impressive images from their limited use of the computer. On the other hand there was fairly widespread skepticism on the part of students as to the value of these particular products. Looking at just one aspect (the product vs. the maker) without an appreciation of the other is deceptive and fundamentally unfair to the needs of the student. Yet, it may be the natural course of events that art teachers, with their course material already defined along the lines of technique instruction, will not decline to look to the ends before recognizing the means.

More than a change of attitude is required, since teachers are not taking sides on the issues as much as they are unsure of what the issues really are. It is a shift in understanding that is most needed. As an understanding of Conceptual Art requires that we retrospectively evaluate all prior art experiences, computers require us to re-evaluate all previous art educational experiences. Were these predominantly technique-oriented? Was that desirable? Art Teachers have based their awareness of materials and objectives upon a traditional body of knowledge which teacher education institutions can now extend in new ways.

2. Pedagogical Issues in Art Education

Art Educators are placed in a largely untrodden position between traditional knowledge and a technological framework that must be understood on its own terms. The use of technology creates new questions of old methods. In this regard teachers will need to know:

(a) What and How to Teach

Leaving the interpretation of the curriculum to individual teachers is established practise, but to put the expectation on these teachers to individually interpret the place of developing technology within their field is somewhat questionable. It is presumptuous for school boards and Provincial Departments of Education to place educators in a position which demands that they have answers, while failing to provide a suitable method of teacher preparation that presents them with the materials they will encounter in the evoloving school system.

Skills and techniques are not clearly separated. The computer inclines such distinction. Art educators must remain alert and wary to what is actually occurring. " Technique and the subject matter are totally indivisible" (Reichardt, 1966:240) and should be taught as parts of a unified whole.

(b) What Standards are in Place to Guide Students and Assist Teachers

Textbook illustrations are somewhat seductive as ideals whether they are the most appropriate or not. These illustrations are often of a type that provides for inexpensive and clear reproduction in books and yet become one of the standards that students will become accustomed to in their day to day exposure. Software images are likewise appealing since at the very least they present something which is complete and accessible from the computer world. That commercial appeal alone gives it strength. For the same reasons of mechanical suitability Art Disks are made available to users. These disks are collections of already drawn images which are considered freeware; that is, everybody is encouraged to use them in their own work. For example, such drawings are provided to assist an office worker or secretary putting together a newspaper article, but they are easily used in any application. Just as wordprocessors are made with a generic user in mind, so too are these images presented for a general commercial audience. Without a great deal of effort and expense at putting in place appropriate visual materials for student use, the marketplace will provide its own.

(c) Whether They are Conducting Evaluations or Quality Control

Evaluations of student work usually includes an assessment of the individual's efforts as well as an evaluation of the acquisition of specific skills which are evident in the artwork itself. Unless art teachers have had sufficient education and familiarization with computers, there exists a very real threat of assessing the output of the student/computer experience, i.e. the computer printout, as indicative of the acquisition of artistic skills. Since the computer is given its power from programmed techniques, and since the most successful images will probably result from a fairly high degree of technical know-how, the student may actually be engaging in technical manipulation that does not constitute a valid art

learning experience. In such a case the teacher too may be looking at student work as a form of quality control.

(d) If They are Instructing in Craftsmanship or Technique

Craftmanship implies a notion of material integrity, of the manipulation of a medium along understood and accepted lines which reflect established characteristics. Whether it is pottery, painting, or carpentry, each can reflect the the characteristics of fine craftsmanship. In such cases technique is utilized to bring the material to life and to display that craftsmanship. It is quite another matter to have an item display the same characteristics, knowing that they were not executed by a person, but through a machine which has been programmed to display specific qualities in *its work* .

3. Student Comprehension and Responsiveness

Students may behave differently within a computer-oriented environment, their work is subject to new rules. Teachers cannot expect the change of materials, student access to their art work and each other, as well as the evolving concept of what constitutes art, to not mean radical changes in their classes.

4. Computer Familiarization

Software and hardware are options, not all or nothing. Any given system or program is not necessarily the most suitable. Teachers need to become critical of their materials. For the first time in a school circumstance, teachers and students have the opportunity to invent and produce their own art materials instead of purchasing them. To the degree that teachers are not taking charge of the computing systems, the computers (through their defaults) will assume that responsibility. Making certain that well educated teachers maintain this responsibility for themselves is only reasonable.

RECOMMENDATIONS

The following recommendations are offered as a consequence of this study:

1. Teacher Education

Art Education courses in understanding technology should be provided as a part of art teacher education, as well as being made available at the inservice level. Teacher education should include a strong component on the role of technology in an historical sense. Teachers need to better understand the need to learn to work with state of the art materials as they become available.

One of the purposes to which teacher education might be directed is that of calling attention to the manner in which student priorities could be compromised. The student's needs must be maintained as a first priority and might be most clearly expressed in relation to the work of art itself. There is a tendency to look at the high quality of a laser-printed image and to pay attention to the printing much like an experienced darkroom technician might evaluate a print. Such an approach presupposes that the intent of the photographer/artist has been met and that ensuring the highest quality reproduction of such a concept is all that remains undone. Because the image has been retrieved from the end-process of the computer environment is not tantamount to it being the expressive end of the art maker's intent.

2. Curricular Responsiveness

The curriculum must allow for, and encourage, technology. At the present time there are no useful guidelines provided even for those teachers and circumstances where compatible art and computer use might coexist. Guidelines for teachers are overdue. Waiting for the situation to become clearer evades the fact that the technology is in constant evolution.

3. Materials Evaluation

Hardware and software should be evaluated in the field, not just by committees. Specific uses for the computer need to be defined by the students (users) as well as the teachers. To this end the computer must be maintained as a tool. In fact it has to be relegated to this function. In so doing the task of utilizing the computer should consciously be directed to maintaining an emphasis on the process of interacting, not just on the witnessing of the interaction through its products.

One of the best ways to ensure this is to require that the computer be treated as a tool which might be enlisted to help fulfill expressive needs rather than purely technical requirements. Administration should be encouraged to open their perceptions of art as being technical in its school-based nature, and computers as being suitable for the advancement of anoetic possibilities.

4. Additional Research

More research is needed in respect to the value of programming graphics by and for art students. This research into the use of a pre-programmed graphics package on a user-friendly computer and its methodology was typical of the manner in which students and teachers will approach the microcomputer in the near future. Nevertheless this study is only one means whereby the potential of the computer is investigated. The use of packages such as MacPaint may possibly also be the most limiting manner in which to use computers. For this reason it is essential that other possibilities be explored and investigated to ascertain the long term inplications of computer use within an art educational setting.

POSTSCRIPT

Changes in technology have created a change in the hardware and software that is accessible to students at least every six months since this study was first conducted. The past eighteen months have brought programs that are more intuitive of user needs and offer more flexibility in terms of image manipulation and presentation.

These changes, while evident to the individual user, are not to be regarded as significant to the findings of this study. They offer drawing opportunities that are more sophisticated in nature but still very close to the principles noted here. Students who used MacPaint would have no difficulty in utilizing these newer programs such as Canvas™, SuperPaint™, FullPaint™, GraphicWorks™ or Modern Artist™.

> Modern Artist© gives you a wealth of colors to choose from (5.5 million simultaneous colors) and special effects, like 3D shading with positional light source, multicolor custom brushes, "wet canvas" color blending, colored glass overlays, air brushes and much more (Advertisement in MacWorld, February,1988).

Another program called PixelPaint™ allows for the use of 256 colors at one time on the screen and a total selection of 16,777,216 colors (if these were Crayola crayons, it has been calculated, laid end-to-end, they would stretch from Denver to Las Vegas. That would be from Calgary to Regina in Canadian.)

What is evident from ads such as this is the tendency for software producers to offer more visual choices and this can only be received in a positive light by the serious computer user. Still, it is just this type of beyond-saturation-range of possibilities that could drive some students completely away from attempting to develop a conceptual approach to their work (to be lost in over-fill) that needs more scrutiny. The results of this study confirm the inclination of students to become directed by the apparent unlimited variations the computer offers. The responsibility for the art educator to try and de-emphasize the technology in favor of the student's interests is going to be a very long-term concern.

Ironically this study into computer use in the art education environment has done a great deal for me in terms of strengthening my conviction in the necessity of good strong art classes within the school system. Prior to this study I would not have hesitated to defend the role and purpose of art educational activities in a variety of rationales, but now I feel its place is of an even more profoundly fundamental purpose. It is, I believe, essential as an arena in which students are given the opportunity to touch the elements. The introduction of the computer as a system will expose students to a possibility of interacting with a simulated environment. Art education can help compensate for this artificiality by offering objects to the senses, allowing students to touch the environment in ways that are becoming less and less accessible.

BIBLIOGRAPHY

BIBLIOGRAPHY

Abbs, P. — Reclamations: Essays on Culture, Mass-Culture and the Curriculum, Heinemann Educational Books, London, 1979

Bangert, C.&C. — Artist and Computer, Harmony Books, N.Y., N.Y., 1976

Barrett, W. — The Illusion of Technique, Anchor Books, 1979

Brad, C. — Technostress: The Human Cost of the Computer Revolution, Addison-Wesley Publishing Company, 1984

Bronowski, J. — The Ascent of Man, Little, Brown and Company, 1973

Bruzina, R. — "Art and Architecture, Ancient and Modern", Research in Philosophy & Technology, V. 5, pp. 163-187, 1982

Burch, R. — "Technology and Curriculum: Toward a Philosophical Perspective", Occasional Paper #24, U.of A, 1984

Chapman, L — Instant Art Instant Culture, Teachers' College Press, N.Y. and London, 1982

Dewey, J. — Art As Experience, Minton, Balch and Company, New York, 1934

Dreyfus, H.L. — What Computers Can't Do?, Harper Colophon Books, 1979

Dufrenne, M. — The Phenomenology of Aesthetic Experience, Northwestern University Press, Evanston, 1973

Eisner, E. — Educating Artistic Vision, The MacMillan Company, New York, 1972

Eisner, E. & Ecker, D.W. — Readings In Art Education, Blaisdell Publishing Co., 1966

Ellul, J. — The Technological Society, Vintage Books, 1964

Ellul, J. — Perspectives on Our Age: Jacques Ellul Speaks on His Life and Work, Canadian Broadcasting Corporation, 1981

Fandozzi, P. R. "Art in a Technological Setting", Research in Philosophy & Technology, V. 5, pp. 3-13, 1982

Ferguson, M. The Aquarian Conspiracy, J.P. Tarcher, Inc., Los Angeles, 1980

Gablik, S. Has Modernism Failed?, Thames and Hudson, 1984

Gardner, J. & Paisley, R. Microcomputer Graphics in Art and Design Education, Trends in Computer Assisted Education, R. Lewis & E. Tagg, Eds. Blackwell Scientific Publications Ltd., 1987

Gendron, B. Technology and the Human Condition, St. Martin's Press, 1977

Gerbay, D. "Director's Statement", Calender from The School of Visual Arts, New York, N.Y., n.d.

Giorgini, A. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Goldman, S.L. "The Techne of Philosophy and the Philosophy of Technology", Research in Philosophy & Technology, V. 7, pp. 115-144, 1984

Greene, M. Landscapes of Learning, Teachers College Press, Columbia Univ., 1978

Heidegger, M. "The Question Concerning Technology", Basic Writings, Harper and Row Publishers, 1977

Hushlak, G. Gerald Hushlak: Computer Works Art Gallery of Greater Victoria, 1982

Ihde, D. "A Phenomenology of Man-Machine Relations", n.d.,

Ihde, D. Technics and Praxis, D. Reidel Publishing Co., 1979

Ihde, D. Existential Technics, State University of New York Press,1983

Kawano, H. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Kroker, A. Technology and the Canadian Mind, New World Perspectives, 1985

Krois, J. M. "Ernst Cassirer's Theory of Technology and Its Import for Social Philosophy, Research in Philosophy & Technology, V. 5, pp. 209-222, 1982

Lanier, V. "The Unseeing Eye: Critical Consciousness and the Teaching of Art", Art Education, Vol. 25, No. 1, 1972

Langer, S. Mind: An Essay on Human Feeling, The John Hopkin's University Press,1980

Laposky, B. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Leavitt, R. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Longson, T. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Marcel, G. Man Against Mass Society, Gateway Editions Ltd., 1978

Marcus, A. Artist and Computer Harmony Books, N.Y., N.Y., 1976

McFee, J.K. "Society, Art, and Education", Concepts in Art and Education The Macmillan Company, 1970

Mezei, L. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Mohr, M. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Montagu, A. & Matson, F. The Humanization of Man, McGraw-Hill Book Company, 1983

Moursund, D. Computers in Schools: A Strategic Planning Symposium Alberta Education, 1986

Mumford, L. Technics and Civilization, Harcourt, Brace and Company, 1938

Mumford, L. The Transformations of Man, Peter Smith, Gloucester, Mass., 1978

Murray, A.H. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Nadaner, D. "A Matter of Life and Death", Vanguard, December/January 1983/1984

Norberg-Schulz, C. Meaning in Western Architecture, Rizzoli International Publications, New York, 1980

Norberg-Schulz, C. Genus Loci, Towards a Phenomenology of Architecture, Academy Editions, London, 1980

Ong, W.J. "Reading, Technology, and Human Consciousness", Literacy is a Human Problem, U.of Alabama Press, 1982

Palyka, D. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Pappas, G. Concepts in Art and Education, The MacMillan Co., 1970

Parkman, R. The Cybernetic Society, Pergamon Press Inc. n.d.

Peterson, D. Genesis II: Creation and Recreation with Computers Reston Publishing Company, 1983

Plummer, G.S. "The Historic Context for Visual Literacy: Walter Smith and Others", Paper presented at annual Meeting of the International Visual Literacy Association, May 1977

Ragsdale, R.G. Computers in the Schools, Ontario Institute for Studies in Education, 1982

Reichardt, J. "Op Art", Concepts of Modern Art, Thames and Hudson Ltd, London, 1983

Reichardt, J. The Computer in Art, Studio Vista: Van Nostrand Reinhold Company, 1971

Scala, J. Artist and Computer Harmony Books, N.Y., N.Y., 1976

Sontag, S. On Photography, Delta Book, Dell Publishing Co. Inc., 1979

Snow, C.P. The Two Cultures and a Second Look, A Mentor Book, The New American Library, 1963

Squires, W. "Creative Computers: Premises and Promises" Art Education, May, 1983, pp.21-23

Verene, D. P. "Technological Desire", Research in Philosophy & Technology, V. 7, pp. 99-112, 1984

Weizenbaum, J. Computer Power and Human Reason, W.H. Freeman and Co., 1976

Winner, E. Invented Worlds: The Psychology of the Arts, Harvard University Press, 1982

APPENDICES

APPENDIX A

Inside MacPaint

How the Program Works

It would seem difficult to understand what the students found exciting, fascinating, and even frustrating about using the computers, without having some awareness of the functioning of the software which they used. This section is included so the reader may better understand the nature of the relationship which existed between the students and their art work by introducing the reader to the basic mechanics of the drawing program.

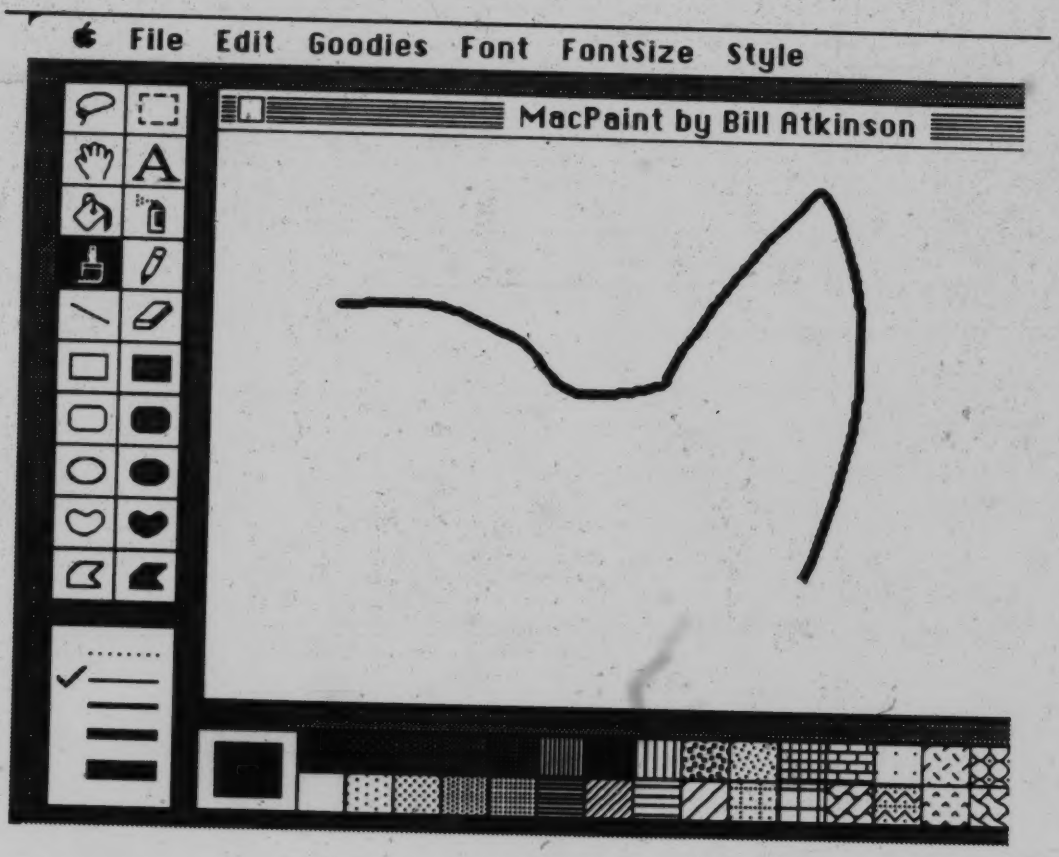


Figure A: The MacPaint™ Program

Figure A is the drawing screen of the MacPaint program. At the top is a line of commands showing an apple icon and the following words:

File Edit Goodies Font FontSize Style

These commands are headings for other subcommands such as those under File which include save and opening instructions for the computer to change and save drawings to the disk.

The various icons represent the tools and options open to the user and are illustrated in Figure B. These icons are accessed by clicking the button on the mouse once the arrow is pointed at the desired tool.

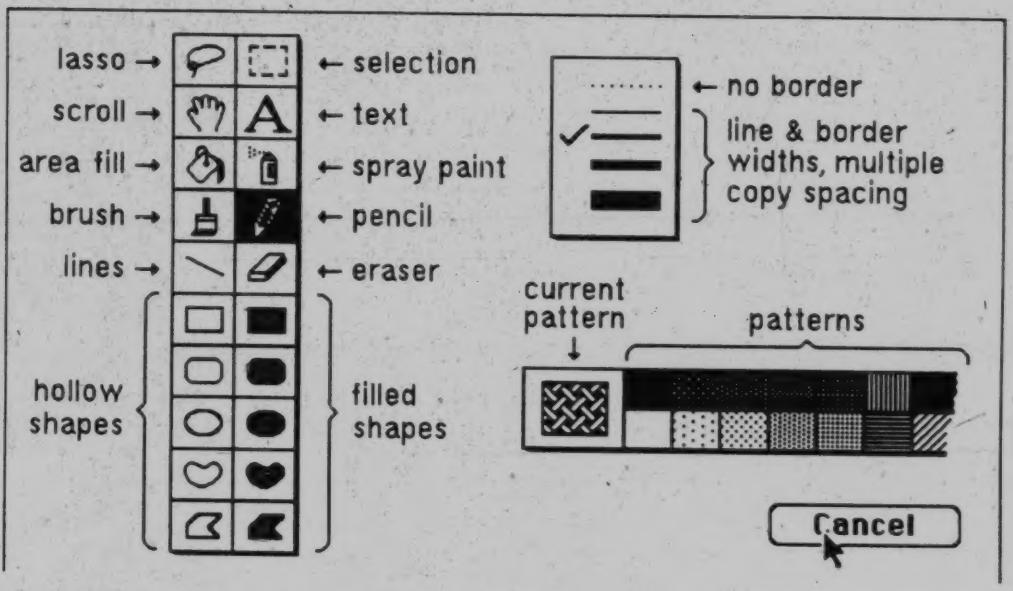


Figure B: Help Screen

The Goodies options include a means of using mirrors to duplicate all drawing movements in a variety of mirrored images. Also included is the ability to alter patterns such as those found at the bottom of the screen. These patterns may be *painted* with brushes or used as *fill* to paint in whole sections.

The icons on the left of the drawing surface are used for capturing existent shapes, moving the page, typing in text, filling areas with patterns, changing brush sizes, using the pencil, drawing computer controlled straight lines, erasing, and drawing a variety of open and patterned polygons. Line widths are variable from the lower box.

The *mouse* is the primary input device for graphics on the Macintosh computer. It is a small hand controlled instrument which contains a rubber ball at its base. When resting on a flat surface this instrument can be moved in a similar fashion to that of a drawing instrument with the movement of the ball translated into the movement of the cursor on the screen. Virtually all drawing, filling in and selecting is made in this manner. For example if the user decided to use the Spray Can they would point to that icon, click on the mouse button once and drag the icon to the drawing surface. Whenever the spray was wanted the user just pressed this same button and controlled the density of the spray by controlling the speed of movement of the can icon.

Figure C: Spray Can Example

Similarly the brush icon will present a brush which lays down patterns or lines when the button is pressed. By double-clicking rapidly on the icon a further selection of rigid brush tips are presented. These offer a variety of effects from a calligraphic image to that of parallel lines.

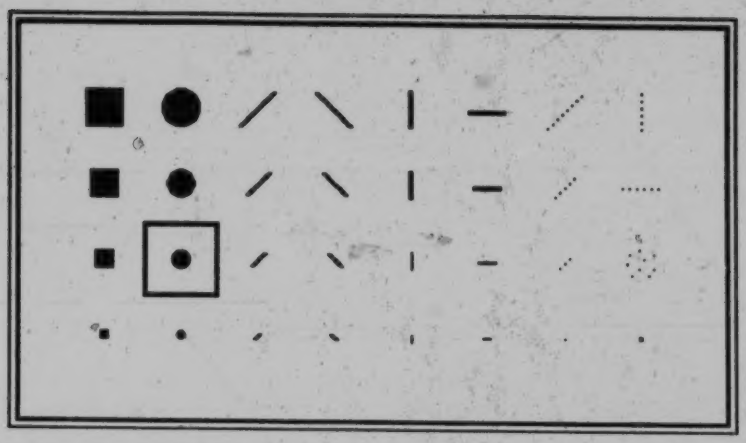


Figure D: Brushes

The strength of the Macintosh computer lies in its design as a graphics processor, all text being treated as small images or pictures. This makes possible an endless selection of fonts (text characters) and accompanying sizes and styles. The computer treats all text and images in a more or less equal manner allowing pages like this one to be put together with relative ease.

Its weakness may be the same as that described as its strength since all operations are greatly assisted by the built-in functions of the computer in combination with the selected software. Students have been quick to see this potential and have been attracted to options such as the Brush Mirrors illustrated below. Up to four mirrors can be set at once to copy the drawing in progress in the selected number of sections. Geometric patterns as well as symmetrical organic shapes were rendered *easy to draw* with the mirrors. Often students chose to make quick mirror images that were randomly composed, and then filling these in with a variety of patterns and textures.

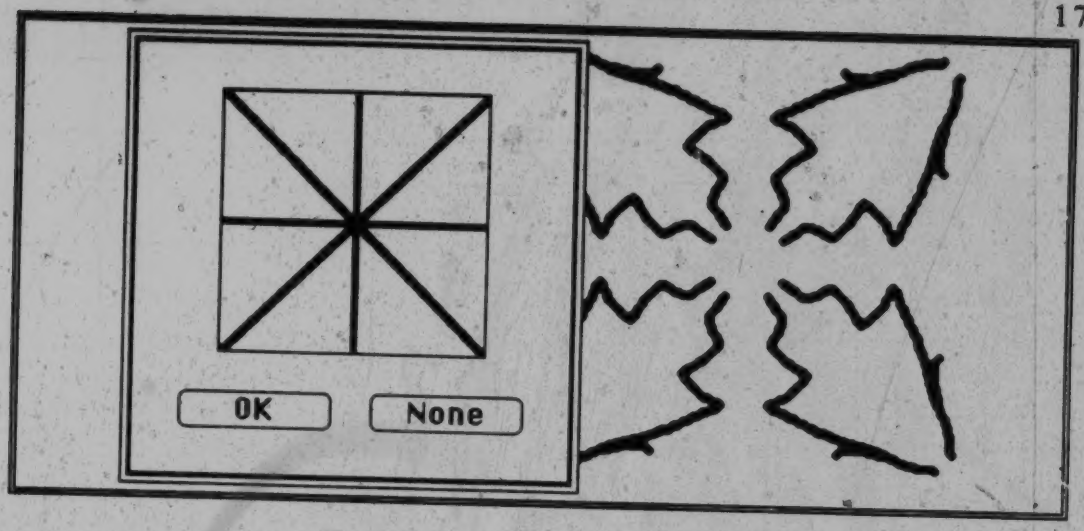


Figure E: Mirror Option with Example

After an image was outlined it could be filled in by choosing the Paint Can and then an appropriate pattern from the set on the bottom of the screen. If none of these were satisfactory the patterns could be edited before filling in the space. Editing was accomplished by rearranging the tiny squares (pixels) which made up an 8 x 8 square. An example of what this effect would look like is shown in an adjacent frame.

Greater control can be maintained in drawing by imposing a built-in restriction on line movement. While the shift key is depressed on the keyboard the mouse can draw in one direction only.

In actuality, the screen shows only about 50% of the *drawing* at any one time, therefore looking "at the whole screen" refers to a moving of the image to a smaller distorted picture to fit the allowable screen size. Other drawing programs offer a variety of means to overcome this problem which is really the result of a small monitor screen being utilized to compose a picture for an 8.5 x 11 inch piece of printer paper.

A few other points must be made so that the reader will better appreciate the students comments. In the context of the use of the computer, the term *pencil* refers to a pencil icon

on the computer screen which signifies the computer is in *draw* mode. Double-clicking on the pencil selects Fat Bits (magnify).

The *eraser* may be used to erase the entire picture by clicking twice with the mouse. This destructive function is unfortunately next to the previous one which is used frequently to enlarge sections for finer control.

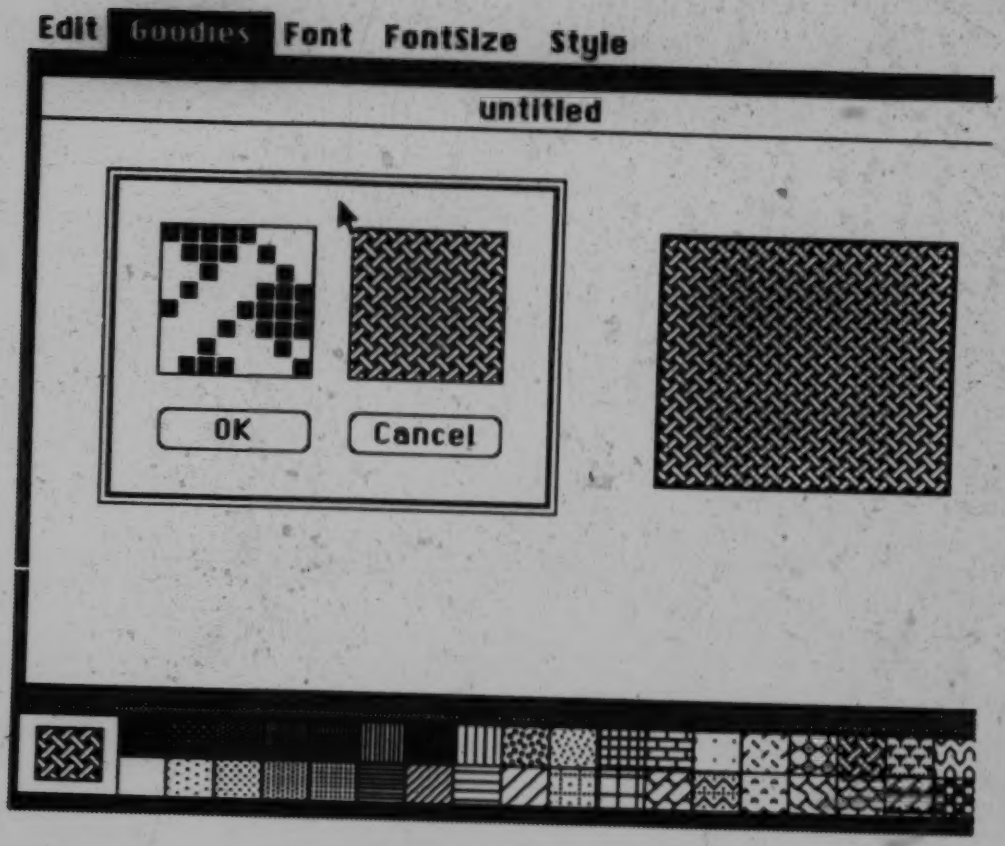


Figure F: Edit Pattern

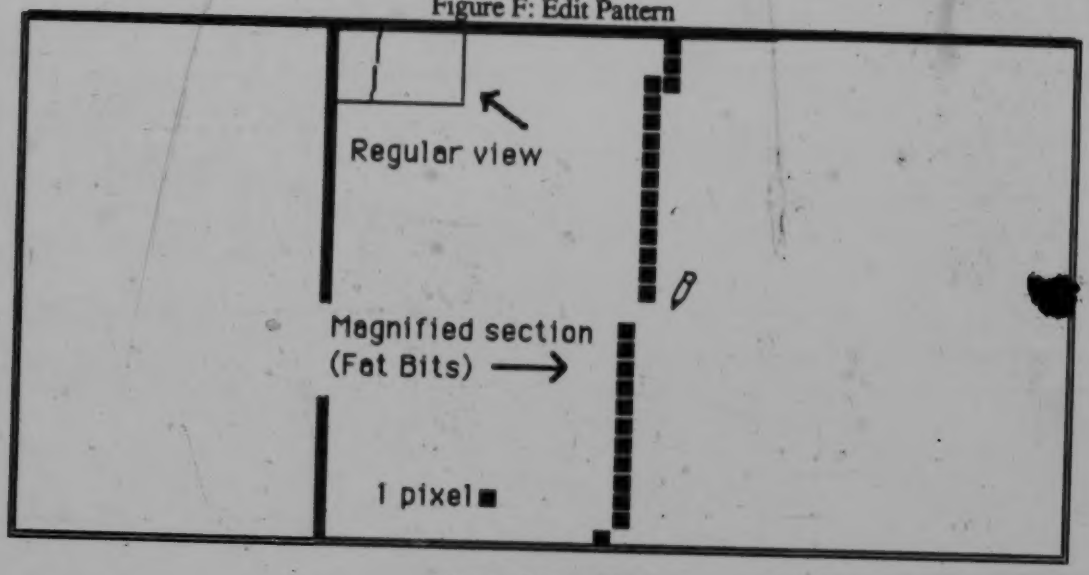


Figure G: Fat Bits

APPENDIX B
Elementary Students

Greg and Jon are in Grade 1.
Mike is a Grade 1 boy who was present for only 1 session.
Matthew and Jared are Grade 3 boys.
Paul is in Grade 3 and was present only once.
Trina and Jody are Grade 6 girls.
Aaron and Kyle are my sons, and are in Grades 7 and 4.

The elementary student transcripts are presented only in partial form. The biggest hindrance to the transcription of conversations was that they were largely non-conversational, e.g. a large part of the time was spent in simply making the graphics audible: "Oooh, this line goes like this. Neat. Wow, this is okay here. No I mean here. Yeah." I believe this living of the line is worth noting and indicative of the depth of involvement these students had with the computer. Still, there was a feeling that such statements presented without long (and maybe questionable) explanations would serve little purpose here.

PRINCIPAL: See how it becomes a pencil. Now see here, Mike. If you push the button and hold it down you can draw. Now I can write your name. MIKE. I guess I should do it in printing. Mike, now you can do that.

MIKE: Yea, I want to do it.
[Mike experiments]

PRINCIPAL: Now, I'll show you the eraser. OK? Now there's the eraser. You can push the button and erase it. OK?

MIKE: Gee. OK.

PRINCIPAL: Now do you want to erase some?

[Small diversion]

MIKE: How do I erase this?

PRINCIPAL: See, Mike. You move the mouse to move the thing on there. See?

MIKE: Ohh.

PRINCIPAL: That's the boy, see? Now, do you want to use the (computer) pencil?

MIKE: No, I want to type.

PRINCIPAL: You want to type? What do you want to type?

MIKE: I want to type letters.

PRINCIPAL: What are you going to do? To type?

MIKE: My name.

PRINCIPAL: OK. Now you push it down. It makes letter after letter and you don't want to do all of these. Mike, just push down the key like this. OK.

MIKE: I like... eh..

PRINCIPAL: Mike, let's make a letter. Mike, listen. Yes, that's better. Now what letter is next?

MIKE: I and C.

PRINCIPAL: That's it.

MIKE: A. And....now....E.....L.

PRINCIPAL: No. That's an I. That's an L over there. See?

MIKE: I want to erase it.

PRINCIPAL: You want to erase it?

[Mike *picks up the eraser* and uses it from the *mouse*.]

PRINCIPAL: Very clever, Mike.

[Mike repeats the entire procedure of typing and erasing. Then he counts 1-10 on the keyboard.]

PRINCIPAL: Okay, Mike. Your all through now. Now what would you like to do? Would you like to draw a picture?

[Mike appears ready to leave the computer and turns to stand. He listens, then agrees as the principal puts the mouse in his hand. The keyboard is pushed aside to give more room for drawing.]

PRINCIPAL: Would you like to use a pencil? Actually the paint brush is better. Look what you can do here. Let me show you how I use the mouse. I only use one hand and one finger on the button.

[Seeing Mike use two hands again, he adds:]

PRINCIPAL: But you can use two hands if you like. Okay? See? That's a boy.

MIKE: But how am I going to work it?

PRINCIPAL: Just keep using the mouse. That's it. Move the mouse. This is a mouse. You have to keep moving it like this.

MIKE: Hey, you're erasing my ....

PRINCIPAL: There, see? Now let the button up. Do you want the paint brush now?

MIKE: Yea.

PRINCIPAL: Okay. Bring this over there. Move the mouse. No, don't touch the button, move the mouse. See how to move the mouse. See. Then you push, click. Then let go. Now it's a paint brush. Now if you move it, it's a line. Just hold it down.
Mike, let me just show you something. Can I show you something? Let's say you wanted to draw, let's say a tree. Then draw like this, you see. Watch the mouse. Mike, see, look, Mike. No Mike. I just keep my hands on the mouse and push down. See?
That's the idea. Now you get the idea. That's it. Sure. A lot better.

PRINCIPAL: [To interviewer:] It's a nice program.

MIKE: I want to erase it now.

PRINCIPAL: Pardon? Oh. I'll show you a nice fast way to erase it. Do you want the whole thing erased? Okay, over here to the eraser and I'm going to click twice. Once, twice, see.

MIKE: [Little laugh as the drawing area goes blank, then he reaches for the keyboard again.]

PRINCIPAL: What are you going to write now?

[No response. Mike starts typing. He reaches the end of the line.]

MIKE: Now what?

PRINCIPAL: Okay. Now listen. Here. If you press this key 'Return', then you can make another line. See.
Watch the screen Mike.

[Mike continues to type. The class bell rings and Mike jumps up to go.]

Wed. March 26

[show how to draw straight lines]

PRINCIPAL: So what are you guys doing?

[Greg has spent about 15 minutes zooming in and out of the fat-bits to correct a straight line he is trying to make with the mouse.]

PRINCIPAL: Oh oh. Now what are you going to do fella?

GREG: Just erase that.

[The Principal turns to Jon who has brought over his paper and crayon picture.]

PRINCIPAL: I see you have a space picture, Jon.

JON: Yes, this is a space picture. I got to put my name on it.

PRINCIPAL: Good boy.

[Just a few minutes remaining. Jon is completing his picture at a table and Greg is continuing to draw, correct, redraw and recorrect his straight line.]

My Comment to Principal: It seems Greg has allowed the computer to get the better of him. He made one line and then started to correct it. Once he started the corrections it got really interesting.

PRINCIPAL: Yea, I think so. Well Greg, what do you want to do? Make the line straighter and straighter, or do you want to draw a picture?

GREG: Well I want to do drawings another day.

PRINCIPAL: Listen, I want to show you something that will make it faster. See that line right there. Well click it there and we can stretch it and then we have a straight line.

GREG: I can do that real fast now.

PRINCIPAL: I know you can. Now you got it.

[Greg tries the line drawing routine, erases it and tries it again.]

PRINCIPAL: Didn't you know about that line before?

GREG: Yes I did. but I didn't want to use it because the last time I got it all mixed up.

PRINCIPAL: Okay, now let's save it.

[The picture is saved and Greg gives up the chair to Jon.]

PRINCIPAL: Okay, Jon. This is the brush. If I choose a line like this, see how I can use this brush. Now I don't know if you want to use this brush, but if you did then this is one way you could draw with it. Okay? And if you want to change the shape then you can draw with any of them.

JON: I want to put my name on it.

[Jon grabs the moveable keyboard which has been tucked away to provide more drawing room in front of the computer. The Principal jumps to its protection and makes it available for Jon.]

PRINCIPAL: Okay, do you want to use the keyboard to do that? Okay, then just click where you want to start your name and then type. Don't hold down the key

because it will repeat. Good. Now what do you want to do? Okay, grab the pencil while I move the keyboard out of your way.

[Jon makes a few shapes with the pencil, then picks up the Fill icon.]

PRINCIPAL: Before you fill it, can you see these lines don't touch?

JON: Oh.

Interviewer: Just use the Undo key if you don't like it. To move the mouse just lift it up.

JON: Will you draw it for me?

Interviewer: What part don't you like?

JON: I want to draw a line around it.

PRINCIPAL: Why not use the paintbrush? It's easier and steadier. See? Know what I mean? Can I show you what I mean? Take the paintbrush and make a nice arc like that. Now see we can fill it up. See? Yea, you got it. Now you see, much nicer. Nice job.
Okay, where did you get that texture? Oh, the spray can. That's going to make it all black, is that what you want.

JON: No, I want to make the comet black, but...

PRINCIPAL: I can see. When the lines aren't touching the color runs through. Those little tiny lines leave little spaces.

JON: I want to get all of this filled in.

PRINCIPAL: We could use the spray can and cover it over, or the large brushes to go over it. Is this satisfying to you Jon. Are you enjoying that? Know what I would suggest Jon? Know what would make your outline straighter? Can I show you?

JON: I don't know?

PRINCIPAL: Show me on your screen. You know what I would do. I would get rid of that whole thing over there.

[include Jon's picture. Jon completes the drawing on the computer and is asked to compare for the Principal.]

PRINCIPAL: Which is better?

JON: This one (computer drawing). My rocket looks much neater on the computer one. It looks more like a rocket.

[Mr. Mills has asked Jon to make a farm picture on the computer.]

JON: Are there waffles on a farm?

Interviewer: Yes, I guess some people on a farm eat waffles. So you are doing a farm picture today.

JON: Yes, I'm doing a picture of what farm people eat. These are waffles. I'm making waffles.

[Jon has started off experimenting with shapes that contain a pattern that he believes looks like a waffle. He has found a way to justify the experimentation within the context of the project.

JON: Good. Now one waffle more.

Interviewer: Well, what will we do next?

JON: I'll erase these now. (click, click, gone)

Interviewer: Next time, Jon, will you let me get a print before you erase the picture?

JON: Okay.

[Jon continues to fill in shapes with the waffle pattern but encounters a problem with some leaky borders which causes the fill-color to run into the background.]

JON: How can I fix it?

Interviewer: This is one way. Just fill in the borders so that there are no gaps.

[The next five minutes is spent checking for gaps, plugging them, and trying out the color-fill again.]

JON: Good.

Interviewer: Is this what Mr. Mills wanted you to do?

JON: I'll erase this now.

Interviewer: What did Mr. Mills ask you to do today, Jon?

JON: He wanted me to do something about farms and I did something they have for breakfast.

Interviewer: Would you like to draw these waffles on paper.

JON: Okay!

Interviewer: Do you think real waffles come in all of these shapes?

JON: No, I'm just making them interesting. I know what to do now.

Interviewer: Is this fun, just drawing shapes over and over again?

JON: I'm trying to draw waffles without touching each other.

[Jon finishes his picture and takes a printout. Greg enters and quickly gets possession of the computer.]

PRINCIPAL: See you Jon. Okay now Greg. We have to write a letter to your Mom. You can have 5 minutes to draw her a picture and then we have to write her a letter. Okay?

GREG: Alright. I'll work on the picture.

Interviewer: That's pretty interesting, Greg. How many mirrors do you have on now?

GREG: Lots.

PRINCIPAL: Know what you could do, Greg? You could make a neat maze, couldn't you? You could make a maze for your classroom.

GREG: Neat'o, eh?

PRINCIPAL: Is it ever?

[Greg finishes his picture and he types in a letter with Mr. Mills assistance. He leaves. Enter Jared and Matthew.]

Interviewer: What's the difference between working on paper and working on the computer. What happens if you make a mistake on paper?

JARED: Well you just see the mistake and then you erase it.

Interviewer: And what happens if you are careless with a computer?

JARED: You just click on the eraser and erase it. Or click twice and erase everything.

MATTHEW: What are you (Jared) going to draw today? I know what I'm going to draw, I think.

JARED: What? Are you going to fool around or are you going to draw something real?

MATTHEW: Well today is 'fool around day'. But I'm going to draw a card for my Grandma and Grandpa. What does their house look like?

JARED: Green. Your going to draw their house? You'll never get it to look like it.

MATTHEW: Well at least I'm going to try.

JARED: Good luck. What are you doing there?

MATTHEW: Yeah, what am I doing?

JARED: Your never going to make it Matthew. You got it.

MATTHEW: What?

JARED: You got it.

MATTHEW: Oh.

JARED: You need a pretty steady hand to draw this.

MATTHEW: Yeah, especially when you draw this bottom line.

Interviewer: Well, if it's a lot harder to draw this way, why bother? Why not just use paper and a pencil?

MATTHEW: Well you can get straighter lines on this.

Interviewer: Some things must be better on paper, and some things better on the computer.

MATTHEW: Well this way it's more fun.

Interviewer: What makes it more fun?

MATTHEW: Well this way it is more of a challenge. And it gets you better at drawing.

Interviewer: Do you like the look of a drawing that was made on the computer?

MATTHEW: Yeah, well like on paper you can't draw the same designs, like what you can do on the computer. Like with brush mirrors you can draw on one corner and it will draw on all the corners.

JODY: Let's draw a clown.
[There is a lot of understanding between the girls as to what a clown should look like. As Trina draws Jody seems to acknowledge every movement with an expressive sound.

TRINA: Don't click it twice! (the eraser)
Make the brush really small.

[A lot of careful movement follows. Both girls hold their breath whenever a minute hand gesture is required.]

JODY: I can't draw the fingers.

TRINA: I know. Let's have him wearing mittens.

JODY: Let me try again, first.

INTERVIEWER: I noticed you draw most things with the circle tool. Any special reason?

TRINA: It's easier.

JODY: Just do one small circle here and see, it works like this.

TRINA: Why not just copy the other hand?

JODY: Two right hands?

TRINA: Yeah, it wouldn't work.

JODY: That's good now. It's fun to draw on the computer.

APPENDIX C

Secondary Art Students

The Questionnaire

Example of the questionnaire given to students with accompanying responses.

1. What types of art activities do you usually find most worthwhile? (painting, sculpture, printmaking, etc.)

Carl	Painting, watercolor, ink-work, pencils
Helen	Drawing and painting.
Jane	I really enjoy painting and sketching because I find them challenging and worthwhile.
Joseph	Illustration, sculpture and broadening my experiential horizon.
Katrina	What I usually find most worthwhile is drawing because of the field I'm going into is fashion design. I feel that when I draw I improve my skills for doing fashion design.
Kyla	The art activities I find interesting are making things like rings, pottery, making plant holders, making those window panes (like the ones they have in churches) with all those different colors of glass. And I like drawing and I like a bit of printmaking.
Lana	Painting, quick sketches, detailed sketches.
Margaret	Painting, sketching and some sculpture. I especially like painting in watercolors.
Marilyn	Drawing, painting, sculpture.
Sheryl	I find drawing in pencil and charcoal as well as painting most worthwhile.

2. What are some of the most enjoyable aspects of trying to use the computer to create art?

Carl	It's fast.
Helen	You can correct mistakes easier. It gives your finished picture a more professional look.

Jane — The most enjoyable aspects of using the computer to create art is that there are many techniques that you can use to challenge your skills. I enjoy the broad range of variety in techniques and also the many, many things you are able to do. By using the computer to create art you find that ideas are easy to come by as you create.

Joseph — Its rapidity. The flawless technical execution. Its versatility and proficiency.

Katrina — The most enjoyable aspects of trying to use the computer is the almost unlimited abilities of it, the only thing that hinders it is the operator's imagination.

Kyla — Some enjoyable aspects are when you draw something and you want to make duplicates of drawing. Like in the MacLab book with the rabbit. Or when you want to move the subject to another place. Also good when you want to see different types of shading and removing it quickly. Also the computer is a lot easier to draw with than drawing with pencil. That's in some people's eyes. But in my eyes it's easier to draw with a pencil in my hand.

Lana — The fact that an image may be altered or changed easily. The use of shortcuts, example: flipping, duplicating, or mirroring an image.

Margaret — It's quick and easy, and enables you to enlarge the picture for fine detail. Coloring in large areas is quick and easy and all mistakes can be erased completely without the trace of eraser marks.

Marilyn — It is interesting to see what the computer can do as opposed to paper and pencil or canvas and paints.

Sheryl — Some of the most enjoyable aspects of using the computer to create art are that you can change things, mix different ideas, and make many copies of the same picture.

3. What are some of the most troublesome aspects of using the computer to create art?

Carl — Trouble in shading. Visualizing the entire page. Making realistic curves.

Helen — Drawing in a small area instead of seeing the whole piece of paper at once. Not having your drawing instrument in front of you, instead having it off to the side and looking at the screen. You have to draw things the same size so the whole, complete picture will be printed.

Jane — The most troublesome aspects of using the computer to create art are that: the computer is very fragile, and a week's work could go out in one mistake. I noticed that if you overload on the patterns your picture will be ruined or lost if you don't "Save As..." every 10 to 20 minutes. A detailed picture can easily be destroyed if the patterns, shapes, etc. overlap.

Joseph — The antiseptic, disassociative feeling; an impersonal contact; its obstinate graphical logic and systematic flow-chart processes; its lack of sensuality or joy in completion of vision; its monochromatic color grid; too many accidents and accidental pieces of 'good' work.

Katrina It is the awkwardness of the "mouse", with a pencil you have more control than using the mouse. Another troublesome aspect is when you accidently push the wrong button(s) and the picture erases or you fill it with a texture or color you don't want, with a pencil this doesn't happen.

Kyla Well for me it's hard to draw with the mouse. I'm just having troubles with this. Me and the computer don't get along too well.

Lana The area you have to work with is too small. When you shrink an image overlapping of dots occurs creating a gridded image. The amount of time it takes to complete a project similar to sketching is incredibly increased. Some computer actions are unpredictable, i.e. eraser can ruin easily.

Margaret You're limited as to what you can do. It is hard to create something that looks painted. You can't overlap drawings, then fill them in. The computer is an extension of the hand and the styles are already programmed in, therefore it's hard for a serious artist to develop a style.

Marilyn It is harder to control and you can't do a drawing and see the whole page at once.

Sheryl Some of the most troublesome aspects of using the computer are that mistakes could ruin the whole picture., it isn't possible to manipulate the computer the way a pencil can be manipulated, and ... (not finished)

4. Comparing computer use to paper/pencil use:

a. What is the major difference in how you control or create your picture?

Carl The pencil is a finer medium. The mouse can't cover the whole page.

Helen The computer only lets me see part of the picture whereas with paper/pencil it is right in front of you, so you can see more clearly what you are drawing.

Jane The *mouse* is like a pencil, but it is harder to control because you are drawing on a screen, rather than (with) a pencil. On a computer you are able to choose the width and heaviness of a line and therefore the thicker the line the easier you are able to control it.

Joseph A disjointed, discordant; no visceral, grass-roots jazziness, nothing. Again, that disassociated separation , the impersonal, distant mechanism.

Katrina In control, the computer falls short to the paper/pencil because I found the mouse to be awkward (I suppose if I worked on the computer a lot, eventually the mouse would not be so awkward but right now it is awkward compared with pencil/paper). In creating a picture on the computer it is more longer of a process than with a pencil and paper, but on a computer you can add texture, color, etc. and it looks more professional than paper/pencil.

Kyla Well when you have the pencil in your hand you are also looking at what your drawing. When using the computer you have to look at the screen alone.

Lana For a large picture, you always have to stop and look at the whole screen - very time consuming. Before filling in a picture you have to check all the

sides - " ". With a pencil you can create more versatile textures etc. One can sketch faster than using a mouse.

Margaret — When using a pencil, control is achieved by what pressure you apply for a dark/thick line or light/thin one (or loosely for a wiggly line or steady for a straight line). With the computer you have a mouse, not a sharp point.

Marilyn — Same as #3.

Sheryl — The major difference is that with a pencil there is more exact choice of lines, and a computer has a wide variety of instruments that can work well together.

b. What differences are there in the looks of the two pictures?

Carl — The shade. The lines are smoother in pencil.

Helen — The computer can make pictures more precise, clean and crisp. The computer is able to erase mistakes completely where as if a pencil/eraser is used the picture does not look as clean/clear.

Jane — A sketch on the computer is too precise and therefore it doesn't really look realistic. On a sketch with a pencil however you are able to make crucial flaws so that you have a much softer and a more realistic drawing.

Joseph — Due to the fixed-vector grid system, circles are not truly circles. No feeling of warmth or tactility in computer graphics images. FLAT. LIFELESS.

Katrina — With paper and pencil compared to computer, the computer has a better look to it (the picture), more professional look to it, it looks clean with no mistakes (if you do things right). With a pencil/paper you can smudge it, not have lines perfectly straight, basically things looking messy and might even take longer than if you used the computer.

Kyla — When using the computer you can get results more faster than pencil in the hand. And the computer could give you more better results than pencil in some points. Then it could be visa versa . For me the results would be better if I were to draw it on paper with pencil in my hand, me and the computer don't get along to well.

Lana

computer	drawing
•limited creation of tones	•more diversified tones -pencil
•limited color	•quicker and looks better
•structured figures look professional	•easier to create texture, more i.e.similar to real life
•limited practical subject matter (something that requires subtle shades never looks right)	•ink scratches even look more realistic
•can't get scratch-work with computer	

Margaret	The computer picture will probably look sharp, neat, with distinct lines. A simple pencil drawing will tend to be more sketchy. A pencil drawing would tell more about the artist and his/her style.
Marilyn	Paper/pencil drawings look more real. Sketches look the same.
Sheryl	The difference between the looks are that a computer picture is smoother, but has a wide variety of texture, a hand drawn picture has more flow and personal style to it.

c. What differences do you note in subject manner? Does the use of the computer cause you to draw things differently than you normally would?

Carl	Perspective works well as well as man-made objects however nature's soft outline makes it difficult.
Helen	It causes me to draw things more sloppier because I know I'll be able to go back to it later and correct it.
Jane	Yes it does. By using a computer you draw things differently because you are able to choose patterns, circles, squares, and other fascinating things which in turn make your job a lot faster and easier. This causes you to draw differently because as you go along, you experiment with the patterns and shapes.
Joseph	Yes. Geometry becomes prevalent, creativity is suppressed, intangible transformation becomes secondary to the mercy of the machine. Art is sometimes meant to counter-oppose or transcend logic, not cater and conform to it.
Katrina	With a computer there is more in terms of subject matter, I find that there is more variety and that you can accomplish more than with a pencil/paper. I find I had to draw things differently than I normally would on a computer because of the awkwardness of the mouse and the endless possibilities you can use whereas with paper/pencil you are limited to what you can do.
Kyla	Yes the computer makes me draw differently. I find it a lot harder to draw with the mouse. I find that I can't draw the subject on the computer but can when I'm drawing with a pencil. That's the big difference.
Lana	Yes, because of the length of time to a create realistic picture one drifts into abstraction, also because of how easy it is to create mirrored, flipped, elongated, etc. images.
Margaret	With a computer the subject matter deals more with perspective and diagrams (i.e. buildings). With the computer I've been very experimental, and I find that I can take the easier way out when drawing, because the computer can draw a perfect line, circle, square, etc... for me.
Marilyn	I feel limited to subject matter. I have drawn only simple line drawings.
Sheryl	It is difficult to draw freely a subject that by hand would come naturally. The computer does cause me to draw things in a harsher manner.

d. Any other differences you have noticed?

Carl — No comment.

Helen — No comment.

Jane — The computer is able to mirror images in seconds with the aid of the mouse, but with a pencil by hand, it would take much longer.

Joseph — Yes, I usually otherwise don't get annoyed drawing, dodging the ghost in the machine.

Katrina — With a pencil and paper, you tire easily of limited drawing. With a computer you never tire of it because of the variety of possibilities.

Kyla — Just that me and the computer don't get along. And that when I go to start drawing I always end up wrecking it.

Lana — Art is usually a very social class where people become very close as they discuss and evaluate each other's work; thereby learning from each other and supporting each other. With the computer it becomes a personal challenge to create something, with no communication of others. Computers also give bad headaches with extended use. There is no personal style to be found with computers, everything has a sameness and can be duplicated easily.

Margaret — (Computers take away some of my imagination) The computer programs that we have been working with are in black and white. This limits the artist to color and directs you more to the texture chart that has already been programmed for you.

Marilyn — I don't feel as comfortable as I normally would be. Doesn't seem to be real art.

Sheryl — A difference I have noticed with the use of the computer is that it takes a lot more to uncover an idea from my mind.

5. Do you think it is worthwhile for art students to have an under-standing of computer use? Is this experience really worthwhile? Why/Why not?

Carl — Yes, pictures I've seen of advanced computer's graphics shows it can be done.

Helen — Yes, because the computer is being used more and more for artistic purposes. It gives the artist a broader range for exploring new possibilities.

Jane — Yes, I find that this experience is worthwhile even if it does get frustrating at times. I find it worthwhile because it is very educational and you learn from your mistakes by experimenting with the computer. The computer's use in arts will soon be used more often in architecture. But I hope that will not take over the arts such as in sketches, because I feel that the art that a person drew on his own, has a whole lot more meaning then that of a computer.

Joseph — Yes, again, it expands and contributes to experience, and yes, it is practical business practice, which is logical, catering to common sense, and despite my

denial of such, it instills artists with common sense, bonding man and machine, his Frankenstein cyborg, with an odd, conceptual marriage of the art and science schools.

Katrina — I think it is worthwhile because I feel that students in art should experience working with the computer because we are moving into the computer age and computer knowledge is so valuable even if you only have a little bit of knowledge of it. The experience is worth noting for career moves in University or college because it seems like every field is getting into computer graphics of some kind.

Kyla — I think the computer is worthwhile for art students. This can bring more areas for career into mind. And that they might find it a lot easier than drawing.

Lana — No.(1st question). Yes, because it opens new areas of exploration and provides art students with a new and unique medium of creation.

Margaret — Yes, because it is one of the options we have as a career in the future. It's nice to try it out and find out if you have hidden interests in computers.

Marilyn — It is certainly worthwhile to have the experience of doing something different and experiment with this "media", but I wouldn't take it seriously.

Sheryl — I do think it is worthwhile to have an understanding of computer use because it is another area of art, and it's important to have a wide field of interest even when there is one specific desire. Also with the growth of computer technology, computers have become an important part of our society.

6. Any other comments at this time?

Jane — It has been an enjoyable experience, it was frustrating, but it was enjoyable.

Joseph — No, not at this time, really. You can't take it fishing, you win all your arguments, and its not as lazy as I am.

Katrina — The comment I have is that we should have more time to really learn more of graphic art design because I feel that we have only just scraped the surface of the usage of the computer.

Kyla — Nothing. Just that I find this hard.

Lana — Every medium has its limitations, but I think it is important to explore the capabilities of this new instrument.

Margaret — I liked working with the computers and think that they are an efficient tool for advertising, architectural work, diagrams, etc., but for an artist who sculpts, paints, sketches, there's nothing like the real thing.

Marilyn — I feel I can't get close enough to the art. There is something separating the art and artist - not as satisfying.

Sheryl — It is difficult to make the switch to drawing on a computer, but once it has been learned, it would be a great benefit for the artist.

Essays

Art 30 students were asked to submit a page or two of their assessment of the computer as a drawing instrument. The following are the written accounts of the students who responded.

HELEN

I enjoyed working with the computer as a drawing instrument. There are many things you can do with it, but there are also limitations that can be quite frustrating at times.

I liked using the computer because I was able to make my drawings more clear, precise and accurate. Especially where I could push the pencil icon twice and one part of the picture is instantly magnified. I could then draw and erase each individual square. I also liked the *undo* key where I could erase the last step I made, without erasing the complete picture. I liked the advantage of selecting my brush size, and off all the texture selections I could choose from. It was good to use the paint can icon to fill in large spaces that would take a very long time if done manually with a pencil/-paper and would not be as accurate as the computer would make it.

I liked the computer because if I drew too large I could always shrink it back down to the size I wanted. I liked the use of the perfect spheres and rectangles because it is quite difficult to draw a perfect circle whether you draw it on the computer or not.

There are some things that I did not like about the computer. Such as the eraser icon. If I accidently pushed the mouse twice, my whole picture would be erased and I'd have to start over again. I also didn't like having to see the whole picture at once. It got confusing, especially if you're drawing a large complicated picture. It was hard when I first began to use the computer because the mouse is off to one side and I looked straight ahead at the screen at my picture. It took some time getting used to it.

I enjoyed working with the computer. In my opinion the advantages outweighed the disadvantages. It took some getting used to. I learned a lot about what can be done with a computer. It gave me a wider perspective of what I want to do in the future. I basically did not know what you could do with the computer in the way of art, because I had not tried it before. Some people would not call it art because it is done on the computer, but it is contrary to that because only a human can control the computer as an extension of a person's talent.

JOSEPH

Can a Machine Think?

The question itself is rhetorical, hollow, meaningless, not deserved of any discussion. However, I firmly believe that approaching the century's fold the redundancy of conversation and insightful, informed intelligence, devoid of media manipulation, and general educated opinion will have been so molded, distorted and altered that one will easily be able to speak of machines thinking, without hidden fear of contradiction. No useful purpose is derived or silently enjoyed by ignoring or concealing these beliefs. There is a conventional mainstream view that computer research scientists proceed methodologically from well-established fact to well-established fact, never influenced by outlandish or unproven conjecture, that is quite mistaken. Provided a proper distinction is made between fact and conjecture, no harm can result, and conjecture is of relative importance since they suggest effective and beneficial lines of research.

I am singly convinced, myself, that Artificial Intelligence advocates have greatly underestimated the human mind, it's complexities, contradictions, ambiguities, mysteries, paradoxes, ironies. There is the simple, dreadful undermining of man's subtle superiority to the remainder of creation, to be shown as necessarily superior, valuing the power of thinking. The emotional connotation is entrenched in the theological objection that thinking is a function of man's immortal soul, God has given an immortal soul to every man and woman (Moslems view woman with no souls) but not to any other animal or to machines, hence no animals or machines think.

Computers place me in a perplexing dilemma; there is no independent thought as instructions are imperative and necessary, and then the implications of computerized thought. The ill-reputed electronic brain conjures the plummeting trend towards obfuscation, the discordant and disparity between factions. An interesting notion, of functional intelligence, of practical mental virtuosity would be an intelligent-quotient test for the stalking machine. However, no machine yet could come down to validating an

objective selection-induction-deduction test with subjective involvement to objectively evaluate and monitor its subjective endeavor.

Based on Turing's The Imitation Game

KYLA

As you already know that I had a hard time with the computer. But I also found it enjoying. The computer is useful for drawing because there are many things you can do that you can't when your drawing. Like when you want to repeat the subject all you have to do is push a few buttons and the job is done. But when your drawing you have to draw it again and again. That's one of the things I liked about it. Others were the mirrors, spray can, paint brush and the letters and also the colors.

The one thing I liked the most was the pencil because I had a very hard time using it as an ordinary pencil. I also found that I ran out of ideas easily too. I like art (drawing) but I don't use my imagination that well. I also don't like where they have the eraser. Sometimes when I go to get the pencil I get the eraser. They should move it down to the bottom.

I actually enjoyed doing this, it was a good experience. I'm also having a hard time writing this. Let's just say that many people will find this a lot more easier than drawing. It may be easy for people to do that and it may help people at their work. Like when your building a house you could draw it on the computer. It was a good experience for me.

MARGARET

Computer Graphics: A Critique

Computer graphics, to my past knowledge, was a long process. I assumed we would be programming our drawings into the computer with the keys. After using the MacPaint program, and becoming more familiar with it, I realized that it was much simpler. During the course of the week I found more things that could be done from experimenting, and also a few drawbacks.

By using the MacPaint program, I found that I was producing drawings much faster than if I was to simply draw them. Straight lines, squares, and circles were easily drawn as they'd been previously programmed into the MacPaint program. Coloring in large areas was also very easy, as it was just a matter of pushing a couple buttons. By using the spray paint I found I could create a picture using pointillism very quickly. All in all, I found it very easy,... almost too easy.

There were also some drawbacks about the computer that couldn't be avoided. I didn't have the freedom that I usually have when drawing with a pencil which made me feel restricted and limited as to what I could do. Also, the mouse was confusing, which made it hard to sketch or draw a straight line. This made me dependant on the computer which could easily draw a straight line for me. I became lazy and started using the computer to its potential and I soon found that it was hard to be creative. After awhile my drawings resembled each other in style, as did a lot of the others in the class.

Computer graphics is a successful means of creating or designing something, or as a means of recording data and other information. It is not however, in my opinion, very good for creating, or recreating, art. Why should I try to create a painterly picture, that resembles a painting, when I can use the real thing? A real painting has depth, meaning, and emotion, whereas a computer piece of art seems imitation, almost one-dimensional.

MARILYN

MacPaint

The experience in the past two weeks regarding the use of the Macintosh 'MacPaint' program had at first been very exciting, but as the days wore on, it got to be somewhat of a drag.

The first day was very interesting, to see how much a computer could do. It was a nice break from the routine of going to art class to draw or paint. To experiment with a different media, I thought, would be good for me. I tried all the techniques available on MacPaint and after I familiarized myself with the computer, I started to do some serious art. After one sketch that I concentrated on, the interest started to fade. And why? Here are some criticisms:

- I do not feel that I am in close contact with the art. (the screen separates me)
- I cannot touch it. My hands do not get dirty like with paint. I can't feel it.
- I can't see the whole picture at once continually.
- Pushing around a mouse and staring into a screen is not my idea of art.
- I find there is less control.
- I need a word processor. This is taking forever to type (on MacPaint).
- I am bored of it. The environment is not comfortable.
- It lacks personal style.

I am glad I was curious to want to try the computer out, just to know what it is like, but now its time for me to get back to my world of art, where I won't have to sit here for one hour thinking of how bored I am pushing little buttons. I think I got my message across so that's all I have to say!

KATRINA

Using Computers for Art

The usage of computers is a relatively new thing in art. In the past two weeks of using the computer as an art tool, I got a taste on the fastest growing industries and how popular the field of graphic art is. The computer I used now was a lot easier than the computer I used only four years ago. The *mouse* is a lot easier than to type everything in but it can get a bit awkward at times when you roll it a certain place it goes off the screen and you have to roll the mouse around until the pencil, brush or whatever goes back on the screen.

The actual *tools* (pencils, brushes, spray paint, etc.) are all very good except the placement of the eraser should be put somewhere where it is not so easily accessible where it is so easy to make a mistake (wipe out a picture or some part you didn't want erased) perhaps at the very bottom would be a good place to put the eraser. Another thing that would be nice is if the screen could hold the whole *page* and you could draw on it so that there is not so much waste of paper by just drawing in only one part of the paper. On that idea, when you do draw a picture as big as the paper, it is hard because of the moving back and forth or up and down and it takes so much time and sometimes the picture then becomes distorted.

A nice addition to the computer would be the usage of color, instead of just black, gray and white, even the textures would look better with color. Maybe when you want to save a picture for a little bit to just push one button to save, sort of like a calculator with a constant memory button which you can recall when you want it. Also with the color (black, gray) and the textures to have a safety catch built in the computer whereas you can't flood the entire picture if you hold down the button on the mouse. If you don't want the colors or textures you should be able to get rid of it by the button we already use (doesn't matter the color or texture or how much different layers of designs and/or colors it should be able to erase layer by layer, so if you didn't want the last couple of layers you should be able to get

rid of it) and this would only be for the color and texture (a separate button than the one to get rid of lines etc., also step by step).

Overall the computer was an enjoyable and different experience. I hope every art student gets a chance to try the computer as I feel it is an educational learning experience and shows you the different options for the individual. My only regrets is that the time spent on the computer was too short to really know all the functions used for art. Otherwise I really enjoyed working with the computer as a creative instrument as well as being a learning tool with almost endless possibilities and functions it can do.

SHERYL

Computers in Art

In our society, in this day and age, computers are becoming a large part of day to day life. We have now come to a turning point in the world of art. Now, even art can be perfected by a computer. It is practically a necessity for every artist to know about how a computer is used for art, but art done by the human hand is still the only real expression of creativity.

Computer art is something that is very useful for every artist to know about. The time may come where the computer is a popular art form. If this is the case, it is important for all artists, no matter what they specialize in, to be familiar with it. Also, computers are a part of the working world and it is an advantage for everyone to know something about computers.

Although it is useful to know about using the computer for art, the only true expression of creativity is made by the artist's hand. More personal style can be put into a work of art done by hand. Unless it is an exact drawing that you want, one done by hand is much more pleasing to the eye. This is because it is actually done by the artist's hand, deciding every mark on the paper. More pride can be taken from a drawing drawn by hand than one in which a computer was used as a tool.

Computers are a very large part of the world today, but they will never be able to replace the skill of an artist's fingers at work. The computers are very interesting to work with, and many new things can be tried with them, but the amount of personal creativity and style that goes into a hand drawing can't be in a computer drawing. A drawing done by an artist's hand will never be replaced by another artist or by a computer.

APPENDIX D

Discussion: Secondary Art Students

Given the difficulty of having a flowing discussion while constantly addressing everyone for the tape recorder, and the lack of perceived worth in an identification of all comments, the following transcript is offered as Interviewer/Respondents only. A double-space between comments signifies a different speaker. The italicized type is the Interviewer.

...What sorts of observations can you make regarding the experience of using the computer for art?

It took too long to draw on the computer. I feel the same way about printmaking. I feel it takes too long to get the drawing done.

Yea, way too long.

The only way I found it took too long was anything which required any detail, not just filling in, it was a real pain.

I thought you might find it faster to use the computer?

But the choice of things I was taking.. Like I was taking birds, textures, faces, and things you would normally sketch, I was trying to find things that I would sketch and make them look a similar style. I found that difficult.

Were any of you successful in creating the kind of style you wanted?

No.

No.

Did it matter?

Well partially because you don't draw on a fixed vector, nothing is on a 90° lattice when you're drawing manually as opposed to the computer. And you don't use a silly little mouse.

I thought the technical side was better suited to the computer?

Oh, yea, the technical stuff. Drafting.

Definitely.

But this was not true of the painterly side?

No.

It's hard to control the pencil with the mouse and to get a straight line and everything.

You should have used that other button.

Yes I know. It's even harder to try and make a gradually going down line.

I never tried that.

Oh, it's almost impossible.

And then you became dependant on the computer to get a straight line, or a perfect square or circle, because all you had to do was push a button and it would do it for you. Rather than using the mouse and the pencil to do it yourself.

That's one of the points I was wondering about. Several people have mentioned that they could let the computer do the work for them. Did you find you did this after a while?

Well really it was impossible not to. You can't draw a circle with just the mouse. You needed the computer too.

When you used the computer than it was really easy.

In short, the program was...

It comes along with trying to draw the circle or the slanted lines.

It's just the way it works. You can't make the small maneuvers without it.

So can we say the computer was controlling your drawing?

I found it was a humbling experience. It taught you how worthless sometimes you really are, how inadequate is your ability to study space and spatial relations. In terms of a manual aptitude, I consider myself reasonably astute. I'm not particularly proficient. The computer, in all of its technical flawlessness is a humbling experience, because as a primarily manual artist, this is not a universal method. This is not timeless and hasn't evolved from the ancients. Whereas drawing and painting are basically the written communication of mankind since he came out of the primordial slime, so this teaches you when it draws the perfect circle, its not manual. It's very flawless, very cardboard, dimensionless.

But we could argue that it is a man-made machine. Isn't this the same as using a pen or pencil?

In an endeavor to extend man's infallibility, so when he has an almost flawless machine, as the creator he considers himself the equal of the machine and he's not. When they say you can't draw a straight line, nobody can draw a straight line. It may look like a straight line but this is an optical tendency, as opposed to a dimensional tendency.
Man could either consider it a Frankenstein or a boon to mankind.

Did anyone feel that they were competing with the machine?

I find that for more natural art, it's better hand drawn anyway. Perfection isn't always the best. You can get your own style in a hand-drawn picture.

Yeah, and more depth.

Let's stay with style before thinking of depth. Why do you say you can get your own style?

Well, it's hard to get your own style into the particular..umm..

It's dispassionate.

It's not fluid.

Yeah.

It's already programmed.

It's very disjuncted, it's like talking through a wall.

All of your lines end up like this [makes gesture like steps on a diagonal line], you don't get smooth lines.

I've heard those words a lot over the past two weeks; flattened out, sterile, and antiseptic.

And you can't actually shade, like you have your different patterns and stuff, but there's no actual shading.

And because you are using the mouse it's very impersonal.

Yes, and you said before that you couldn't actually touch it, or see the whole picture.

You can't get back and see what you have done.

Okay, what about depth?

No matter how much shading or patterns you use it still looks flat. It looks very flat.

Is that because of the screen or what?

All it really is is a rearrangement of blacks and grays.

There are problems and restrictions with the computer, but some of the time spent must have been enjoyable. Would some of you like to mention anything about that part?

Brush mirrors.

No mess.

Easy.

Are there any good reasons? What kinds of trade-offs were there?

A master would have to master the computer before he could master or translate his own techniques. Picasso would have trouble adjusting to the computer.

Do you think he would have tried?

No, I don't think so. And if he did, would he be mediocre or just show pedestrian talent.

I think Picasso would have experimented. And so would Da Vinci...

Yeah, Da Vinci probably would have invented it.

Toulouse-Lautrec would certainly have used it.

I don't think the Impressionists would.

Seurat would have used it.

Oh, yeah, Seurat, but not the Romantic Post-Impressionists or the Expressionists. But I think that's the question. It's one of style. You don't have a style on the computer.

There is another way of using the computer so that you take a picture and change it with the computer so that you get an absolutely perfect picture.

Perfect in what sense?

Ah, well if you can get someone who can't draw too well and you put that in it then it can actually be better.

I think one of the selling points of art software is that it tends to say to people, "you're abilities are no longer a problem. The computer will help you draw."

My Dad says that I should get into computers because some day they are going to take over the art world.

If computers can be programmed to paint like, let's say, one of the so-called Master's, and this painting is properly representative of all of the techniques of that artist, then what is the benefit of art?

Wouldn't that tend to make art lose its value?

Art will become deceased.

It's photography-art.

One way I think the computer will take over is design, like advertising.

Well it's a marriage of convenience.

Totally.

Man is a lazy creature. It's nothing more than a plaything.

Those are lyrics for a song.

Many artists shape their own visual madness. I can't consider a concept like madness or vision in terms of a fixed vector, cathode ray, 64 sector phase. It doesn't work. Or that's not the way I feel it.

What is important about the human way to make art?

Because there are emotions involved in art.

You are creating something.

Some of the strongest works are irrational. A lot of these works are done purely on emotions and they are irrational in a lot of ways.

I don't think a computer can duplicate. Its programmed to do functions, but it can never be entirely original.

Some people believe that some of our human traits can be...

But why duplicate it?

The computer can't think about what's going on around it.

What is worthwhile about this experience for you?

It was educational?

In what way?

We got to learn more about computers, like up until now I was interested in advertising. I realize now how much computers are involved in advertising.

Going back to an earlier point, the artist is nothing more than a simple medium between this empty void, this emptiness and... He translates the ordinary, the banal, the everyday, into something which is timeless, universal.

But can't the computer do that?

No, no, no. Not at all. Because... Generally artists conform to the image of translating something from an intangible mystery, something untouchable, into something relegated. With a computer there is no sense of subjective reasoning.
Does the computer have morals?

Let's take a little change here. Let's have everyone say a few words about what you thought of your own personal experimentation with the computer.

I don't know. I just didn't get along with the machine. I work better with a pencil, with my hand. Like having the mouse in my hand and looking at the screen didn't work for me. I enjoyed the experience and learned quite a bit, but I wouldn't work with computers anymore.

Did you feel threatened by it? As if there was too much for you to control?

No, not in a way. There was lots there I didn't know how to use.

Anyone else?

It was good because I worked with pointillism and things that I did in art. I once had a chance to work on a computer and used it for about 3 hours. It was great, but I didn't take it seriously. It was a learning experience but I could never take it seriously.

Do you normally take drawing seriously?

[The Art Teacher has just entered the room. There's friendly laughter as a student has now been asked to incriminate herself with an answer to my question. She answers:]

Well I find drawing more serious.

[The Art Teacher smiles and states:]

Well there's one thing I want to say and I'm not going to stick around for the whole thing, and that's that it's very important to be curious about new things. Because if you're not you're gonna be left behind in the dust. With this exposure you've just had to computers, I think this is great. I'm really super-impressed with the work I've seen here.

It would be a good thing to have in the schools for art students to look at. Because once we are taught pointillism or shading and all of these other things, you can apply it on paper or on the computer.

Problem with the shading was that the patterns didn't blend.

[Interviewer:]
You didn't have the control you expected?

I didn't change any of the textures. I knew they could be changed but I didn't bother. Somehow it didn't make me want to be creative. Rather than shading I would just get the old paint can and fill it in.

I liked it. Overall some things took a while, but I liked it.

When you worked with a picture for a long period of time what kinds of problems were there that you didn't have with pencils and paper?

The really big problem was not seeing the whole picture, and a lot of time I would erase the whole picture before I could save it.

Given a chance would you use the computer again?

I really liked it. I enjoyed it.

I'm really glad I tried it, but I couldn't take it seriously. I thought it was neat to see what it could do, but I couldn't sit down long enough to do a picture. Like I didn't feel like it.

Was it you who kept saying that you couldn't move your arm, that there were too many limitations of working on a small surface; you liked to make big gestures normally?

Yeah. A problem with drawing with the mouse was that when you drew the screen seemed to be far away.

I find it interesting that you can spend a lifetime acquiring a very subtle skill of moving your hand, in very small ways for drawing and for fine work. You have a sense of how far that is, and when you convert those motions into the computer you can make small motions, like in magnify mode, and you get very big lines, or in regular mode you make big movements to get small lines. The natural relationship between your drawing motion and the image seems to be changed quite a bit as a result of using the computer. Also, someone mentioned last week they felt there was no change in feel between the brush, or the pencil or the spray can.

It's the same mouse.

That's right, the same instrument. So you lose that tactile feedback from the brush.

So you consider art textural?

Well I think it is a very important component.

Oh, I do.

That's one thing I found really frustrating after a while. It got so that it really bothered me.

What bothered you?

Not being able to touch it. Not being able to hold it.

Like no matter what you use, a pencil, brush, whatever, it still turns out the same, a paper, a print. Like a painting has a rich texture, the paper doesn't.

You always have little black squares.

The computer lets you duplicate someone else's work easily.

I was marooned in a techno-shock existence. It catered to my every whim and desire. But I was also frightened of it, so I maintained an objective distance from the beast's projection. I was afraid to go in and rearrange texture.

Were you afraid it would rearrange you? To change you?

I wanted to control it. No it wouldn't change me, but I wanted to maintain an objective distance from it. I think it is a mindless machine.

I liked the computer. I liked it for a change. Because you know, you work with the same kind of medium all your life, now you can work with the machine on a more one to one basis.

There's more marriage with paper.

One thing I noticed, and I don't think it was mentioned was line variation. If you wanted the line darker you just pushed the pencil harder.

The mouse just skids.

I like to draw on different parts of the picture at once, and I feel that I really had to stay with one part when I was on the computer.

After I did one picture and I didn't have any problems, I kind of liked it after that. After I had made lots of mistakes like pushing the eraser twice, which destroys the picture, or make a line and fill it in and there's a gap and everything fills in and then you use what you think is a pencil and it's a brush and it really makes a big mess.

Any final comments?

I think anyone can do art with the computer.

Except that it's not real art. I get no emotional response from it.

Any pedestrian pseudo-talent can walk in off the street and do a Picasso.